Diseases peculiar to Ages—Particular ages have their particular diseases These diseases peculiar to age are perhaps more of the specific than of the common kind and age is little more than a natural or remote cause there being some immediate cause acting so as to produce the disease

The age of man may be divided into three parts 1st The age of growth 2d The stationary age 3d The age of decline The first and last are absolute but the second is not so easily ascertained it not being very easy to say where the first ends and the last begins The young subject and old are more susceptible of many diseases than the full grown or stationary but they are not subject to the same diseases The young are more susceptible of scrofula than the middle aged but particularly more than the old and this scrofula may produce consumption which we know is peculiar to youth The young have few affections of the mind excepting those arising from natural passions or immediate sensations of the body

The middle age would appear to have but few diseases peculiar to it excepting nervous affections and hypochondriasis &c The foundations for the diseases of old age are often laid by intemperance during the middle age

In the old we have perhaps as great a variety of diseases as in the young In the old the power and necessary action are not well proportioned even in health much less therefore in disease This produces a degree of irritability often increasing inflammation and terminating frequently in mortification In the old we have the gout which seldom takes place in the young Cancer is peculiar to the latter part of the middle age and still more to the old Gallstones are to be found chiefly in the middle aged and old Ossifications of arteries are rarely found in young persons The bladder becomes less disposed to stretch and more irritable hence old people make water oftener than young The prostate gland is more subject to indurations The mind gradually becomes more attached to this world and the things that are in it the nearer it approaches to a separation from it

JOHN HUNTER FRS

Lectures on the Principles of Surgery circa 1786–1789

SURGERY IN THE AGED

Editors

FRANK GLENN M.D.

Lewis Atterbury Stimson Professor of Surgery
Cornell University Medical College
Surgeon in Chief The New York Hospital

S. W. MOORE M.D.

Professor of Clinical Surgery Cornell University Medical College
Attending Surgeon The New York Hospital
Assistant Visiting Surgeon Bellevue Hospital

JOHN M. BEAL M.D.

Associate Professor of Clinical Surgery Cornell University Medical College
Attending Surgeon The New York Hospital

The Blakiston Division

McGRAW HILL BOOK COMPANY INC

New York Toronto London

SURGERY IN THE AGED

Library of Congress Catalog Card Number 60-6969

23490

Dedicated to the

memory

of

CAPTAIN VINCENT ASTOR

contributor to the alleviation

of

the sufferings of mankind

Contributors

JOSEPH F ARTUSIO JR B S M D
Professor of Anesthesiology in Surgery Professor of Anesthesiology in Obstetrics and Gynecology Cornell University Medical College Attending Anesthesiologist in Charge The New York Hospital

WILLIAM A BARNES A B M D
Associate Professor of Clinical Surgery Cornell University Medical College Attending Surgeon The New York Hospital

JOHN M BEAL B S M D
Associate Professor of Clinical Surgery Cornell University Medical College Attending Surgeon The New York Hospital

PAUL W BRAUNSTEIN B S M D
Assistant Professor of Clinical Surgery Cornell University Medical College Assistant Attending Surgeon The New York Hospital

EUGENE E CLIFFTON B S M D
Associate Professor of Clinical Surgery Cornell University Medical College Associate Attending Surgeon The New York Hospital Assistant Attending Surgeon Memorial Hospital Assistant Visiting Surgeon Bellevue Hospital

HERBERT CONWAY M B B S M D M S
Professor of Clinical Surgery (Plastic Surgery) Cornell University Medical College Attending Surgeon in Charge Plastic Surgery The New York Hospital Visiting Surgeon Bellevue Hospital

WILLIAM A COOPER A B M D
Associate Professor of Clinical Surgery Cornell University Medical College Associate Attending Surgeon The New York Hospital

GEORGE N CORNELL M D
Assistant Professor of Clinical Surgery Cornell University Medical College Assistant Attending Surgeon The New York Hospital

PETER DINEEN M D
Assistant Professor of Clinical Surgery Cornell University Medical College Associate Attending Surgeon The New York Hospital

HELENA GILDER A B M D
Assistant Professor of Surgery (Biochemistry) Cornell University Medical College Research Associate in Surgery (Biochemistry) The New York Hospital

FRANK GLENN M D
Lewis Atterbury Stimson Professor of Surgery Cornell University Medical College Surgeon in Chief The New York Hospital

GEORGE JOHNSON M D
Instructor in Surgery Cornell University Medical College Resident in Surgery The New York Hospital

RICHARD C KARL A B M D
Assistant Professor of Clinical Surgery Cornell University Medical College Associate Attending Surgeon The New York Hospital

VICTOR F MARSHALL M D
Professor of Clinical Surgery (Urology) Cornell University Medical School Attending Surgeon in Charge Urology The New York Hospital Associate Attending Surgeon Memorial Hospital

JOHN M McLEAN M E M D
Professor of Clinical Surgery (Ophthalmology) Cornell University Medical College Attending Surgeon in Charge Ophthalmology The New York Hospital

JAMES A MOORE B S M D
Associate Professor of Clinical Surgery (Otolaryngology) Cornell University Medical College Attending Surgeon in-Charge Otolaryngology The New York Hospital

S W MOORE B S M D
Professor of Clinical Surgery Cornell University Medical College Attending Surgeon The New York Hospital

WILLIAM F NICKEL A B M D
Associate Professor of Clinical Surgery Cornell University Medical College

Surgeon The New York Hospital Associate Visiting Surgeon Bellevue Hospital

ALBERT J PAQUIN M D
Associate Professor of Clinical Surgery (Urology) Cornell University Medical College Associate Attending Surgeon (Urology) The New York Hospital

BRONSON S RAY B S M D
Professor of Clinical Surgery (Neurosurgery) Cornell University Medical College Attending Surgeon in Charge Neurosurgery The New York Hospital Consulting Neurosurgeon The New York Hospital Westchester *Division Neurosurgeon Memo*rial Hospital Visiting Surgeon in Charge of Neurosurgical Service Bellevue Hospital

S FRANK REDO B S M D
Assistant Professor of Surgery Cornell University Medical College Assistant Attending Surgeon The New York Hospital

BJORN THORBJARNARSON M D
Assistant Professor of Surgery Cornell University *Medical College Assistant Attending* Surgeon The New York Hospital

PRESTON A WADE A B M D
Professor of *Clinical* Surgery Cornell University Medical College Attending Surgeon The New York Hospital

GEORGE E WANTZ M D
Assistant Professor of Clinical Surgery Cor*nell University Medical College Assistant Attending Surgeon* The New *York* Hospital

Preface

Surgical therapy among the aged is increasing year by year and the need for a treatise on this subject was indicated by physician response to an article by the senior editor on this subject which appeared in the Bulletin of the New York Academy of Medicine. This article also evoked the interest of the Blakiston Division of McGraw-Hill and they approached him with the idea of a composite volume prepared by the New York Hospital—Cornell Medical College Surgical Staff. The publisher felt that the considerable experience of our staff with this group of patients should be made available to all physicians. Frankly, it was flattering to receive this expression of interest. After a series of interdepartmental conferences our group concluded that such an undertaking could best be accomplished if each of us considered those subjects which we dealt with in our daily work. Thus gynecology is not included in this volume because in this Center it is within the Department of Obstetrics & Gynecology.

As the material was brought together in the 30 chapters of this book the importance of surgical therapy for the aged in over-all practice became even more and more evident. Because the proportion of our population 65 years and over is increasing, there is a corresponding increase in the incidence of conditions requiring specific medical care. Surgery is now more frequently indicated and accepted among the older age group than ever before. By precision management both in preoperative and postoperative care as well as careful adaptation of anesthesia and surgical procedures to the individual, surgical therapy has become safer and easier for the patient. Because there is variability in the capacity of the older age people to withstand the burdens of surgical procedures, be they diagnostic or therapeutic, judgment and skill are essential in correlating what is to be done with the individual and the circumstances then existent.

Within the various areas of surgery dealt with by the 26 authors there are many facets; many of these are common to the over-all, but about an equal number are specific to the condition being considered. These are reported from personal experience and observations. It follows, therefore, that much more could be added and still the subjects would not be complete. The objective has been to present the experience of a group working together in a teaching medical center.

Credit is due to each contributor and their long-patient secretaries who have typewritten these pages in addition to their daily work. This cooperative endeavor has thus been a pleasant, albeit at times an arduous one. Special recognition is well deserved by Mr. Milton Zisowitz for editorial guidance and arrangement, Mr. Frank Robinson for illustrations, and Miss Vivian Bowe who has read and corrected proof as well as participated in the completion of the original manuscript.

Finally, thanks are expressed to the publisher representatives for inviting us to produce this treatise and for their everlasting patience and guidance in its preparation. We as authors have enjoyed working with them.

FRANK GLENN, M.D.
S. W. MOORE, M.D.
JOHN M. BEAL, M.D.

Contents

Introduction

Frank Glenn

In 1900 the average life span of the 76 million persons in the United States was 50 years In 1958 the 175 million Americans may look forward to an average life expectancy of 70 years This trend of the past 58 years has been consistent and it is reasonable to expect that it will continue Thus the composition of our society is changing Not only is the total population greater but a larger proportion of this population consists of persons who are 60 years of age or older These changes challenge those who must study problems of health One area of inquiry concerns the factors that have been responsible for the greater longevity A second and equally urgent problem and one that directly concerns the medical profession is the provision of medical care for this changing population

Several factors have contributed to this trend The development of natural resources has resulted in a general increase in wealth and living standards have greatly improved In the past 60 years there has rarely been a scarcity of food Housing and living conditions as well as hygiene and sanitation regulations have improved in both urban and rural sections of the country Associated with the great development of the nation s resources and prosperity there has been a remarkable expansion of facilities for research in the biological sciences These have provided spectacular advances in knowledge which have been translated into better medical care and into progressively improving health programs There are few disease processes that have not shown a significant decrease in morbidity and mortality since 1900 These factors are prominent among the reasons that approximately 14 per cent of our population or about 24 million persons are now 60 years of age or older

The second challenge to study concerns the medical problems that are presented by these 24 million persons While it is apparent that the incidence of chronic illnesses is higher in this segment of our population than in the younger groups of patients, their prominence must not obscure the significance of acute diseases that are not related to chronic or degenerative processes Although cardiovascular disorders and cancer are leading causes of disability and death in the elderly these individuals are subject to many of the same illnesses that are prevalent among younger patients such as infection trauma and emotional disturbances Early detection and prompt therapy are as appropriate for the old as for the young

Obviously the frequency with which chronic or degenerative conditions are encountered in older individuals does influence the management of such patients particularly when operation is indicated The margin of safety is greatly diminished as age increases and therefore precision management is required In addition it would appear that in many older patients the control of infection and shock is rendered more difficult because degenerative processes are present Thus in the elderly patient the approach to the primary disease must be considered in conjunction with associated chronic or degenerative illnesses

In recent years the hospital population in large institutions such as The New York Hospital has reflected the change in population as a whole There has been a progressive increase in number of patients beyond the age of 60 Surgeons are being required

to operate upon older patients more frequently, and there is an increase in the age at which surgery is needed It is now generally accepted that age alone does not preclude surgical treatment

Certain diseases requiring surgery increase in frequency with age This is perhaps best exemplified by studies of the incidence of cancer and of biliary tract disease Many published reports have considered disease processes and their treatment without particular regard to age Because the response of elderly patients often differs from that of younger persons, it has been felt desirable to present experiences in the management of the aged The physician who desires to assemble information about the experience of others with this age group must usually search through divers reports and scattered journals For a number of years the staff of the Department of Surgery of The New York Hospital–Cornell Medical Center has been accumulating experience in the treatment of the aged This volume is presented in the hope that it will be of assistance to others in the management of surgical problems in this substantial and ever increasing segment of our population The material which is presented in the following chapters is based upon the experience in this institution Where indicated, this experience has been compared with that of others Emphasis has been placed upon the frequency of associated conditions the type of treatment and results and the complications that may be anticipated

A review of the operative mortality is perhaps most effective in placing the problem of therapy of the elderly patient in proper perspective During the 5 year period 1953 to 1957 there were 21 655 operations on the surgical pavilion service (including the surgical specialties) There were 343 deaths after operation an operative mortality of 1 6 per cent Of the 343 deaths, 174, or approximately 51 per cent occurred in patients 60 years of age or older The age differential in operative mortality is even more striking when the analysis is made according to systems The accompanying table shows that more than three fifths of the deaths in operations for cancer, fractures, emergency problems, and genitourinary diseases were in patients 60 years of age or older Another significant observation was made when the mortality in emergency operations was contrasted with that in elective procedures Fewer than half of the patients who died after elective operations on the general surgical pavilions were older than 60, while 70 per cent of those who died after emergency operations (including fracture) were in or beyond the seventh decade of life

These figures emphasize the major contribution that the elderly patient presents to hospital mortality and morbidity Improvement in the care of these patients and reduction of mortality require study of the causes of death and an awareness of the types and frequency of complications that occur during the course of treatment

Operative Mortality of the Surgical Pavilion Service 1953–1957 *

System or category	Total no. of deaths	Deaths patients 60 and older	Per cent 60 and older
Emergency operations	59	38	64 4
General			
Cancer	77	5	67 6
Liver and biliary tract	21	7	33 3
Cardiovascular	39	5	12 8
Gastrointestinal	23	11	47 8
Miscellaneous	11	7	63 6
Fracture	18	16	88 9
Neurosurgery	55	1	21 8
Otolaryngology	3	0	0
Urology	34	6	76 5
Plastic	3	0	0
Total	343	174	50 8

* The New York Hospital–Cornell Medical Center

Part 1

Fundamental Concepts

1

Physiologic and Metabolic Problems

George A. Cornell, Helena Gilder, Albert J. Paquin, and John M. Beal

With the increasing longevity enjoyed by our population has come an expanding interest in the study of the physiology peculiar to the aging organism. Biologists as well as clinicians have been hampered in this study by three frustrations which remain to be resolved. First is the lack of information on alterations in the intracellular processes peculiar to the aging individual. Second is the problem of distinguishing alterations due to the passage of time alone from those due to associated disease, the latter being reversible at least in theory. This is especially true in the patient who manifests such degenerative diseases as generalized arteriosclerosis or emphysema. Third, owing to the fact that the backgrounds of persons reaching the geriatric age are highly variable, gross individual variation is evident in most studies, thus hampering the formulation of any significant general conclusions.

In the following sections the authors will define, so far as present knowledge permits, those physiologic changes common in the elderly patient which have a bearing on his response to operative or accidental trauma, describe the usual metabolic response to trauma in this age group, and finally discuss the important factors which influence this response.

PHYSIOLOGIC CHANGES

Certain physiologic alterations are encountered often enough in older patients so that the surgeon who is called upon to treat such a person must have them well in mind and be constantly alert for them. The older patient with a surgical problem represents the sum total of his past experience. Socioeconomic factors, traditions, habits, and intelligence level all affect the individual's response to trauma. Frequently, retired persons must adjust to a diminished income. This single factor may lead to less desirable housing, restriction of social contacts, and a decrease in the quality and quantity of nutriments. This results in a patient who, in addition to his immediate difficulty, shows loss of body vigor due to a decrease in physical activity and a narrowed mental outlook, the end result of circumstances which have had a deleterious effect on both physical condition and personality.

Some of the personality traits which appear to manifest themselves frequently in the elderly patient may interfere with good management. The elderly patient may show varying degrees of depression, somatic delusions, terror, and distrust, especially when ill. Since trust and cooperation are mandatory for good management, such psychic symptoms may retard the patient's recovery. These manifestations should not be mistaken for the delirium and confusion noted in the ill elderly patient, which may be the prodromal signs of a serious metabolic disorder.

Malnutrition is commonly encountered in the geriatric age group. This may be a minor problem brought out only through a very

careful history or it may present as a full blown clinical picture characteristic of a severe *dietary lack or imbalance of the essential* foods Economic and dental problems may force the elderly patient to replace nutriments containing adequate proteins and vitamins with a cheaper and more easily masticated carbohydrate rich diet Additively in many patients seeking surgical aid the disease process exacerbates the nutritional deficiencies The nutritional state of the patient should be evaluated by noting specifically a history of weight loss hepatomegaly and unusual concavities in body contour due to a loss of muscle mass Anorexia and diarrhea *with peripheral edema may indicate an advanced* stage of malnutrition

Despite the frequency of malnutrition in the older patient group studies have revealed that malabsorption problems are unusual in those who are enjoying generally good health When offered a balanced diet they store protein but they do resist protein intakes in excess of 100 Gm per day Hypochlorhydria may be encountered in the geriatric patient and the incidence of this condition appears to increase with each additional decade of age This decrease in gastric acidity impedes iron and calcium absorption to some degree and decreases the production of intrinsic factor However aside from these minor points it is unusual to find absorption or motility problems Therefore oral feeding is preferred whenever possible in treating metabolic disturbances

Cardiovascular function in the older patient may show a loss of cardiac reserve even though symptoms are absent In one study 60 per cent of patients over the age of 60 years were found to have moderate to advanced coronary arterial sclerosis A decrease in basal pulse rate stroke volume and cardiac output *amounting to about one per* cent per year for each year beyond the fiftieth has been demonstrated as characteristic of the geriatric patient Observations on the electrocardiographic tracings in the older patient have shown that only 1 patient in 10 will show a normal tracing Myocardial ischemia, conduction and rhythm abnormalities, and left ventricular hypertrophy were noted in 9 out of 10 patients who were beyond the age of 65

Pulmonary function defects may be present in the elder patient and when the stress of surgery is *superimposed serious metabolic* disturbances may ensue Vital capacity maximum breathing capacity, and inspiratory reserve volume decrease with advancing age, while fixed lung space increases There is a decrease in the area of pulmonary capillary–pulmonary alveolar contact and diffusion studies have shown a more uneven distribution of gases in the lungs These defects *in pulmonary function increase in each decade* beyond the fifth and are the cause of the significant increase in respiratory volume noted in older subjects after controlled exercise Thus the older patient must breathe longer and harder to obtain the oxygen he requires and this alteration in pulmonary reserve handicaps the pulmonary component of acid base homeostasis

Oxygen consumption and carbon dioxide production diminish and a corresponding decrease in metabolic rate has been observed in patients who have attained their fiftieth year The decrease in basal metabolic rate approximates 3 to 5 per cent per decade of age beyond 50 years This lowered metabolic rate appears to be unaccompanied by a decrease in thyroid function as far as this is *measurable at the present time Thus in the* older age groups protein bound iodine and radioiodine uptake values are the same as those found in the young adult age group

With the exception of the gonads and pancreas the remainder of the endocrine glands show only slight alterations with aging when older patients are compared with young adults Following the climacteric in both sexes there is a significant decrease in the daily 17 ketosteroid excretion At present it is felt that this decrease may be accounted for by the decrease of gonadal steroidogenesis in the older patient While quantitative studies are available to show a decrease in the secretory products of the pituitary and the adrenal

cortex with each decade within the geriatric age period these decreases do not appear to be physiologically significant The otherwise healthy aged patient appears to have an adequate reserve as far as the function of these glands is concerned

The older patient s response to insulin is definitely changed and there is a reduced response to the insulin tolerance test Even in the absence of clinically detectable diabetes, the patients of this age group show a decreased tolerance to glucose whether it is given orally or intravenously This lowered glucose threshold and the decreased response to insulin appear to be due to a decrease in peripheral tissue oxidation or, as we shall see below to a decrease in the proportion of the body weight taking part in active metabolic processes

Changes in body composition associated with aging may now be studied using any one of a number of isotope dilution techniques Applying the dilution method to patients it is now feasible to measure total body water (TBW) and extracellular fluid volume (ECF) Figure 1-1 represents the total body

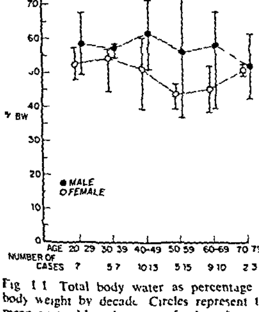


Fig 1 1 Total body water as percentage of body weight by decade Circles represent the mean vertical line the range of values for each decade and sex

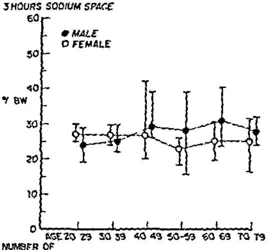


Fig 1 2 Three hour sodium space as percentage of body weight by decade Circles represent the mean vertical line the range of values for each decade and sex

water determined in the authors laboratories in 88 patients with deuterium oxide as the isotope Despite the wide individual variation there appears to be a definite decrease in the percentage of body weight contributed by body water beyond the fourth decade This is especially true in women where characteristic changes in body composition are associated with menopause These data are in agreement with other reports of similar studies

All the methods for measuring the extracellular space have intrinsic limitations The authors have employed the 3 hour sodium space or dilution volume using radiosodium to measure the extracellular fluid volume This method gives higher values for the extracellular fluid volume than those obtained with inulin owing to the migration of part of the isotope to an intracellular position and to transcellular areas of the body However in the authors experience this method has satisfactorily mirrored changes in the extracellular fluid volume The results of this determination in 93 patients are presented by decade and as per cent of body weight in Fig 1 2 The general trend of a slight increase in the extracellular fluid with advancing age has been confirmed by others The

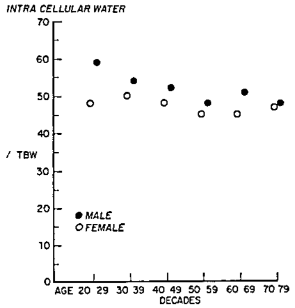


Fig 1 3 Intracellular water as percentage of total body water by decade Intracellular water was determined by subtracting sodium space from total body water *True* intracellular water is lower than that calculated here because ex tracellular fluid measured with radiosodium is larger than the true The figure shows a trend only

corollary to this increase in extracellular fluid volume with an associated decrease in total body water is a decrease in intracellular fluid volume This trend is apparent in Fig 1 3 where intracellular water is plotted as percentage of total body water The decrease in absolute amounts of total body water and intracellular water with advancing age would indicate that the cells themselves have be come slightly dehydrated while the extra-cellular volume has increased especially in the elderly male On the other hand a re duction of metabolically active cell mass with age is indicated by the decrease in total ex changeable potassium The finding that cell water is decreased may therefore represent merely a diminution in the number of cells the function of those remaining being un impaired The pertinent data on the body water compartments in relation to age are summarized in Table 1 1

From the determinations for total body water and given the body weight it is pos sible to calculate the percentage of body weight contributed by lean tissue and that contributed by body fat As lean tissue has a relation to total body water, another corol lary of the decrease in total body water with aging is a relative increase in the body fat This increase in the amount of body fat is most marked in females beyond the fifth decade and is characteristic of the tendency of women to accumulate fat during meno pause The recent emphasis on the dangers of taking on fat in aging may change this situation in the future In general it would appear that with advancing age the decrease in physical activity is responsible for a de crease in muscle mass and an increase in the percentage of body weight due to fat

Figures 1 4 and 1 5 describe the blood and plasma volumes in this group of patients As noted by others there is a slight but pro gressive increase in plasma volume in the geriatric age group accompanied by a de crease of red cell mass

Renal function in the older age groups appears to share in the attrition of aging noted in other organ systems Anatomic studies show that the number of histologi cally intact glomeruli is progressively reduced in the older patients as compared with their younger counterparts Function studies sup port this in that glomerular filtration rate renal plasma flow and renal tubular excre tory capacity tend to decrease progressively

TABLE 1 1 EFFECT OF AGE ON BODY COMPOSITION *

	S x	*D c d*				
		30 39	40–4[illegible]	[illegible]0 59	60 69	0 9
Body wt kg	M	69 (7)	6 (13)	6 (1)	61 (1)	63 (6)
	F	65 (6)	56 (11)	71 (6)	63 ( )	57 (4)
B dy wat % of bod wt	M	8 ( )	6 (13)	56 (15)	61 (10)	5 (3)
	F	54 (5)	51 (10)	44 ( )	46 (9)	51 ( )
Na²⁴ sp e % of body wt	M	6 ( )	30 (13)	9 (19)	30 (1)	28 (F)
	F	(6)	(11)	3 (6)	6 (9)	f (4)

*S e t t f r m th ods Figur in parentheses are n nbers of patie ts averaged

beyond the fiftieth year Urea clearance in the octogenarian outwardly enjoying good health has been found to be reduced to roughly half of the clearance demonstrated by the patient in his fifties Associated with these commonly encountered reduced renal activities is a decrease in the ability of the older kidney to do osmotic work Studies in patients deprived of water for a comparable period show that in patients over the age of 65 the ability to concentrate urine beyond a specific gravity of 1 026 is significantly decreased with each decade of survival This loss of concentrating ability by the older patient means that he must produce a greater volume of urine than does the young adult to clear his plasma of waste products When these alterations in renal functions are considered together with the deficit in pulmonary function noted above it is obvious that the mechanisms of acid base homeostasis in geriatric patients are frequently impaired Studies in which the older patient has been both acutely and chronically challenged as far as

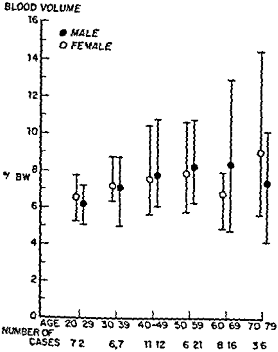


Fig 1-4 Blood volume as percentage of body weight by decade Circles represent the mean vertical line the range of values for each decade and sex

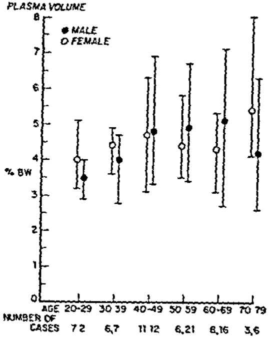


Fig 1 5 Plasma volume as percentage of body weight by decade Circles represent the mean vertical line the range of values for each decade and sex

acid base reserve is concerned have borne out his lack of reserve in protecting homeostasis The elderly patient is especially handicapped in situations leading to respiratory or metabolic acidosis and may be unable to protect himself from shifts in serum pH

For the most part water and electrolyte metabolism in the geriatric patient appears adequate to meet the demands of day to-day existence This is borne out by repeated observations that serum values for sodium potassium chloride carbon dioxide and osmolarity are usually within the limits considered normal for a given laboratory

Occasionally the surgeon will encounter a geriatric patient who demonstrates an abnormally low serum sodium concentration which does not cause symptoms The lack of symptoms is believed to be due to a lack of a corresponding decrease in extracellular fluid volume This syndrome of asymptomatic hyponatremia is commonly seen in any patient who has lost 15 per cent of his body weight regardless of the cause or who demonstrates a severe anemia The low

serum sodium value is probably dilutional and is attributable to the accumulation of salt free water secondary to body tissue catabolism However when the surgeon finds that his patient has this syndrome he must be doubly watchful as the state is one of diminished reserve In the face of apparently insignificant water and/or salt losses, these patients will progress rapidly to a typical azotemic state Peripheral vascular collapse follows shortly unless treatment to alter the chain of events is instituted promptly

Thus it seems that the aging process affects the function of all of the body systems to a certain degree The emphasis on the commonly encountered physiologic alterations in the geriatric patient noted above is not meant to deter the surgeon but rather to enable him to anticipate his patient s problems Age in itself is no longer a contraindication to surgical relief of a disease process As will be borne out in the remaining chapters of this book the elderly patient demonstrates a physiologic stamina which is attested to by his survival into the older age We must await further advances in the fields of cellular biology however for a more fundamental understanding of the nature of aging In the interim let us consider what has been observed of the response of the geriatric patient to trauma

RESPONSE TO TRAUMA

Over the past two decades a large number of independent observations have accumulated in the literature on the metabolic response to injury The volume of these reports now justifies the assumption that when an individual sustains an injury, he will show a predictable metabolic response to that injury Many of the data on the metabolic sequence following trauma have been collected by studies carried out on patients requiring elective operative procedures This does not imply that research methods are necessary to the successful management of the geriatric patient It is neither necessary nor practical to apply such tedious methods to all patients in the older age group It is mandatory, however that the surgeon who undertakes the operative care of the elderly patient have clearly in mind the physiologic events his patient is experiencing Only with the metabolic sequence clearly in mind is it possible to manage the geriatric patient with the precision necessary for uncomplicated recovery For descriptive purposes it is possible to recognize within the dynamic state of convalescence four stages through which the patient passes from the time of injury to complete recovery These stages are defined by changes in fat and protein metabolism during the recovery period

As the patient reacts to his injury or anesthesia his body mobilizes emergency mechanisms which make energy available to the organism which compensate for fluid volume imbalances resulting from injury and which initiate restorative processes The first stage of convalescence begins by definition with either the onset of the injury or the onset of anesthesia When the elderly patient is awaiting elective surgery, however, the preparation and anticipation of the coming operation conditions him for some time before the onset of his anesthesia and he is especially susceptible to the emotional stimuli of this waiting period The geriatric patient must be protected from overreacting to the anticipation of approaching surgery This is best accomplished through individualized sedation and through ensuring an adequate amount of sleep

The metabolism of the first stage of convalescence is characterized by the loss of body tissue and the conservation of body water Glycogen stores are mobilized to meet the body s energy requirements Endogenous protein breakdown gluconeogenesis as well as the mobilization of fat stores supply the organism with the energy it needs The loss of endogenous protein is indicated by the marked increase in the nitrogen content of the urine Associated with this increased excretion of nitrogen is an increased excretion of intracellular electrolytes namely potassium phosphates and sulfates Con

versely the sodium content of the urine is decreased due to a conservation of this cation

A reduced urine volume is also characteristic of the immediate postinjury state This observation has been noted so frequently in the patient subjected to trauma that it is referred to as the period of *physiologic oliguria* The urine produced during the oliguric stage has a specific gravity which approximates the highest value the patient s kidneys can produce The solute content of the urine becomes linearly related to urine volume and water loading during this period will not induce a diuresis In the geriatric patient with a reduced cardiovascular reserve this is especially important Water loading the elderly patient in this stage of convalescence may be inviting heart failure

As the patient recovers from anesthesia or injury he usually shows a tachycardia and evidence of peripheral vasoconstriction His body temperature may be elevated and his blood clotting time is reduced As the first stage of convalescence progresses the patient s vital signs return toward their preinjury levels During this catabolic stage the patient is suffering from a moderate amount of pain He resists movement and has little interest in his surroundings He is usually able to tolerate only small amounts of clear liquids by mouth This first or catabolic, stage of recovery lasts about 3 to 5 days

The second stage of convalescence is characterized by a slowing in the rate of endogenous protein depletion and a release of the water conserved during the first stage The slowing of endogenous protein depletion is demonstrated by a gradual reduction in the nitrogen content of the urine As this second stage goes on the patient is able to increase his dietary intake This increasing intake of protein and calories balances out the diminishing nitrogen output and the nitrogen balance approaches equilibrium or zero balance Associated with the decreasing output of nitrogen is a similar decrease in the outputs of potassium phosphates and sulfates The increasing dietary intake gradually supplies more and more of the e substances with the result that their balance follows that of nitrogen

Early in this second stage of recovery there is an increase in the volume and sodium content of the urine which has a diminished specific gravity Thus diuresis and natriuresis last 2 to 3 days When the patient in basal condition is carefully weighed at the same time each day an indication of the magnitude of the water shifts which have occurred in the first two stages becomes apparent Following diuresis these same daily weights show the attrition of body tissue which has occurred up to this point in convalescence As this stage draws to a close the patient is less restricted by his pain although still weak He is up and about more and takes greater interest in what is going on around him

The third stage of recovery which may be termed the anabolic stage is characterized by the repletion of endogenous protein expended during the previous two stages Similarly the potassium phosphate and sulfate balances become positive in that the patient s intake of these electrolytes exceeds his output Despite the shift of protein catabolism to anabolism fat depletion continues through most of this stage and may be indicated by a continued weight loss Early in this stage the patient s wound has healed sufficiently for his skin sutures to be removed He is up and about the floor most of the time and expresses an interest in his discharge date It is the authors experience that once the patient is well into this stage of his convalescence he may complete his recovery at home with every assurance that his course will be satisfactory

The fourth and final stage of convalescence is characterized by the repletion of the body fat which has been expended during the previous stages The duration and amount of restoration of body fat accomplished during this stage is more closely related to the patient s intake than it is a function of convalescence Convalescence is complete when the patient s weight stabilizes The physio-

logic events and metabolic changes of each stage are summarized in Table 1 2

Of particular interest in the phenomena involved in recovery is the high biologic priority afforded the wound A correlation of wound healing and the metabolic sequence following injury demonstrates that the wound accomplishes most of its healing during the time the patient is approaching the most depleted period of his convalescence Despite the high priority awarded the wound a successful recovery from either injury or operation demands that the patient pass in an orderly manner through at least the first three stages of convalescence Prolongation of the first or predominantly catabolic stage of recovery endangers the patient s life This is best demonstrated by the unfortunate patient who has sustained an extensive full thickness burn Here the large and open wound drives the patient s metabolism to a predominantly catabolic state In patients with severe burns the increased metabolism has been shown to be associated with an increased oxygen consumption The same patients showing this increased oxygen consumption during the recovery from a severe burn did not show increased thyroid function by the other parameters of function measured

The patient who has sustained multiple injuries or who has sustained an intraabdominal catastrophe such as perforated viscera is maintained by his injury in the first or catabolic stage of recovery The insult of the injury sustains the patient in the depleting stage until the institution of adequate treatment Other factors which are within the control of the surgeon will also prolong the first stage of recovery and thereby jeopardize the patient s course The open wound the presence of necrotic tissue within the wound infection depleted blood volume the untreated fracture and dehydration all prolong the first

TABLE 1 2 SUMMARY OF THE PHYSIOLOGIC AND METABOLIC EVENTS IN CONVALESCENCE BY STAGES

Stage	*Duration days*	*Characteristics of the stage*	*Physiologic changes*	*Metabolic changes*
I	3–5	Endogenous tissue loss (catabolism) Water conservation	Tachycardia Fever Peripheral vasoconstriction Reduced blood clotting time Oliguria	Glycogenolysis Endogenous protein catabolism Gluconeogenesis Increased excretion of nitrogen potassium phosphates and sulfate Endogenous fat catabolism Retention of water and sodium
II	4–14	Diuresis Reduced protein depletion	Vital signs return to pretrauma levels Diuresis	Slowing of endogenous protein depletion Decreased excretion of nitrogen potassium phosphate and sulfates Diuresis Natriuresis Endogenous fat loss continues
III	5–21	Restoration of depleted protein	Return of gastrointestinal function Ambulatory	Protein anabolism Positive potassium phosphate and sulfate balances Positive nitrogen balance Water and sodium balances become related to intake Endogenous fat loss continues
IV	6–30	Repletion of body fat	Completion of convalescence	Nitrogen potassium phosphate sulfate and sodium balance in equilibrium Repletion of body fat

stage of recovery Therefore it is of the utmost importance in the geriatric patient that these factors be corrected as soon as possible in order that recovery may continue in an orderly fashion

The authors have been unable to discover a significant qualitative difference in the metabolic sequence of recovery exhibited by the geriatric patient from that of a younger person subjected to a similar degree of injury This statement is based on personal experience in detailed metabolic studies carried out on over 25 patients over 65 years of age These patients were subjected to varying degrees of injury and studied under many different circumstances

FACTORS INFLUENCING RESPONSE

Certain factors significantly alter the quantitative nature of the geriatric patient s metabolic response to injury For the present discussion most of these factors may be reduced to three These are the magnitude of the injury the patient sustains the nutritional state of the injured person immediately prior to injury and the incidence of major complications during convalescence Under certain special conditions there appears to be a difference in the quantitative nature of the response between male and female and this will be discussed later

Probably the most important factor which changes the quantitative nature of the response to injury is the magnitude of the trauma It is readily apparent that the response of the patient to the excision of a small skin lesion under local anesthesia is distinctly different from that of the patient who has sustained a severe burn Practically speaking the response in the former patient is not measurable while the latter shows a protracted and prolonged period of recovery Between these two extremes there are quantitative differences in the metabolic sequence which may best be brought out by example In Fig 1 6A and B are shown the metabolic balance charts of two patients both of whom were in the geriatric age group Patient A A (Fig 1 6A) an elderly woman underwent cholecystectomy for cholelithiasis The balance chart shows that the depletion of endogenous protein as indicated by the nitrogen balance was minimal in amount and of brief duration This patient was started on oral feedings on the second day after operation and tolerated a general diet by the fifth post operative day Simultaneously with the resumption of a general diet her nitrogen balance reverted to anabolism The second stage of recovery is obscured The amount of endogenous fat loss was insignificant and the patient requested a reducing diet prior to discharge The transient water retention is indicated by the transient gain in daily weight indicated at the top of her balance chart

Patient D T (Fig 1-6B) however was an elderly man who required radical cystectomy for carcinoma of the bladder The

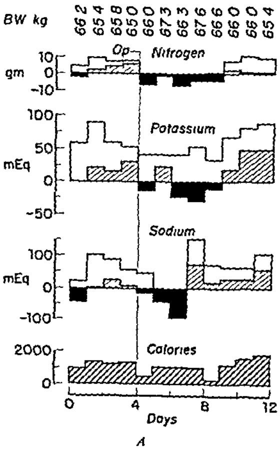
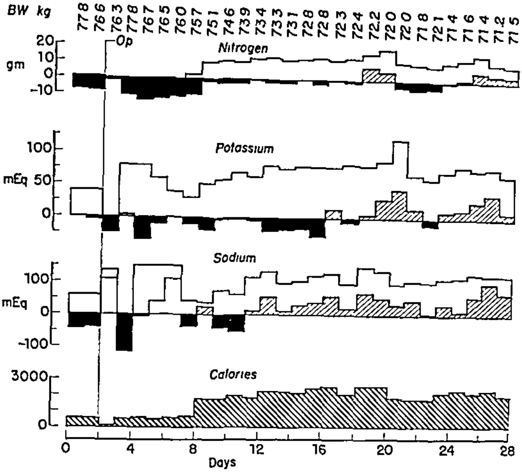


Fig 1 6 A Metabolic balance chart on patient A A (cholecystectomy)



B

Fig 1 6 B Metabolic balance chart on patient D T (radical cystectomy) See text for charting method Positive balance indicated by shaded areas above zero line negative balance by black areas below the zero line

stages of recovery in this patient were so pro longed that despite the length of his hospital stay he was discharged before the fourth *stage of his convalescence became apparent* The first stage of endogenous protein loss is considerably greater in duration and amount than that recorded in the patient recovering *from cholecystectomy* This patient was ad vanced to a general diet by the sixth day fol lowing cystectomy yet in spite of a good dietary intake his second stage of recovery was prolonged until the sixteenth day after operation The characteristic electrolyte changes outlined earlier in the description of the stages of recovery are more apparent fol lowing the greater degree of operative trauma than they are following cholecystectomy

Certain of the characteristics of the met abolic sequence following injury are demon strated only in those patients sustaining the greater degrees of trauma Intensive study of a group of patients who required radical *cystectomy has brought some of these char* acteristics to light Within this group of pa tients the loss of body solids during the first two stages of recovery averaged 4 0 Gm per *kg of body weight per day* During the first two stages this loss of body tissue was con tributed to by both endogenous protein and fat Once the third or anabolic stage of re covery was entered however the same aver age loss of body weight continued Indirect calculation indicates repeatedly that once the third stage of convalescence is reached, the loss of body solid is accounted for entirely by the loss of body fat The relationship of body tissue depletion following radical cys tectomy is shown in Fig 1 7 Of further note

within this patient group was the finding that once the patient began to replenish the lost protein during the anabolic stage there was an associated secondary retention of sodium and water during this period of recovery

It appears that following the degree of trauma represented by radical cystectomy the geriatric patient mobilizes endogenous fat at a maximal rate which averages 4 0 Gm per kg per day The fasting patient and the patient subjected to operation are compared in this respect in Fig 1-8 Despite the maximum mobilization of endogenous fat stores this patient group demonstrated that they were able to use more fat than that supplied from endogenous stores Thus during the stage of protein anabolism this patient group continued to lose body fat at the same average rate despite a daily caloric intake of approximately three thousand calories Fat catabolism may take metabolic pathways in the patient recovering from severe trauma different from those employed in the patient who is subjected to fasting alone The question of the caloric equivalence of these fat losses following radical operation remains a problem which only additional study may answer

The nutritional state of the patient immediately prior to his trauma is a significant factor which influences the quantitative nature of the metabolic response to injury Earlier in this chapter it was pointed out that nutritional deficiencies especially of protein are commonly encountered in patients in the geriatric age group Therefore the surgeon confronted by a problem in the nutritionally deficient elderly patient should watch for the quantitative alterations demonstrated in response to trauma The characteristics of the depleted geriatric patient are best brought out by example In Fig 1 9 are shown the metabolic data obtained from the study of an elderly Negro woman who required the degree of operative trauma represented by total gastrectomy for advanced carcinoma of the stomach This patient had lost 23 kg of weight over the 9 months prior to admission Following admission it became apparent that

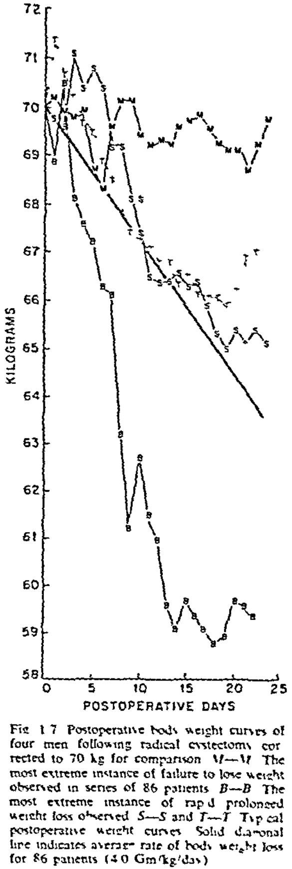


Fig 1 7 Postoperative body weight curves of four men following radical cystectomy corrected to 70 kg for comparison M—M The most extreme instance of failure to lose weight observed in series of 86 patients B—B The most extreme instance of rapid prolonged weight loss observed S—S and T—T Typical postoperative weight curves Solid diagonal line indicates average rate of body weight loss for 86 patients (4 0 Gm/kg/day)

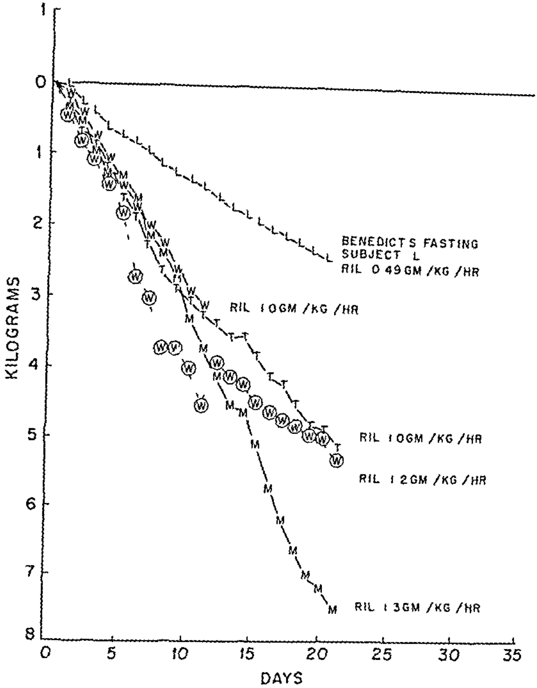
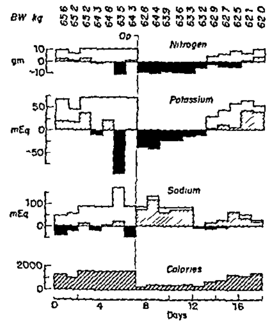


Fig 1 8 Relation of body fat loss (Peters method) to the rate of insensible weight loss (*RIL*) following radical cystectomy and during fasting

her ability to eat was compromised by the advanced nature of her lesion Despite this the patient did store some protein prior to surgery *This was accomplished on an intake* which was inadequate in both calories and protein for a patient of her admission weight This points out a characteristic of depleted patients *namely, that they appear able to store protein more efficiently on a smaller intake than are well fed persons* When faced with a patient suffering from nutritional deficiencies one should whenever possible take advantage of this characteristic *and attempt to correct at least the protein* deficit before operation Returning to the metabolic balance chart in Fig 1 9*A* it will be noted that the amount of this depleted patient s daily protein loss, as indicated by her nitrogen balance is distinctly less than that observed in patient D T (Fig 1 6*B*)

who enjoyed a satisfactory nutritional state prior to cystectomy In general following operation the depleted patient will lose less endogenous protein during the first two stages of recovery than will the one in a good nutritional state subjected to the same degree of trauma Further when the deficient and the well fed patient s convalescence periods are compared the former is seen to revert to protein anabolism at an earlier date In Fig 1 9B the data obtained from the study of the deficient Negro woman are plotted in a different manner Here the entire study is plotted cumulatively Operation is indicated in the figure by the appropriate symbol The patient s protein metabolism is expressed in terms of lean tissue change (ΔLTM) Alterations in endogenous fat stores are indicated by changes in body fat (ΔBF) and changes



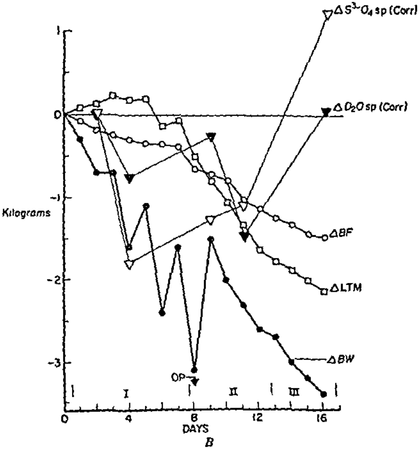
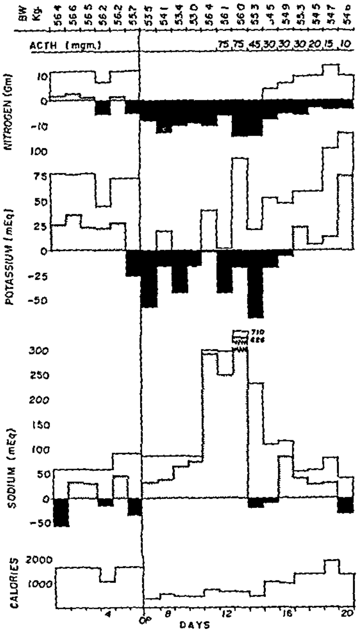


Fig 1 9 *A* Metabolic balance chart on depleted patient subjected to total gastrectomy *B* Alterations in body components in depleted patient subjected to total gastrectomy before and after surgery

in body weight are indicated by ΔBW Total body water is expressed as changes in the deuterium oxide dilution space ΔD_2O sp (Corr) and extracellular space changes are expressed in terms of radiosulfate dilution $\Delta S^{35}O_4$ sp (Corr) The details of how the data are obtained and calculated as expressed in Fig 1 9*B* have been reported in another publication This cumulative charting method here is used to bring out the relative changes which occurred in this patient s body compartments *during the period of study* Associated with the slight increase in her lean tissue mass prior to operation there was a significant loss of weight which is accounted for by a loss in total body water mainly in the extracellular fluid space Hyperhydremia is a common finding in the severely depleted patient and appears to be due to an expansion of the extracellular fluid space The retention of water in the depleted patient repairs itself once the patient is able to eat a sufficient quantity to correct his weight loss Following operation the depleted patient who required a total gastrectomy for the removal of her advanced lesion shows the loss of protein characteristic of the first two stages of recovery The rate of loss and the duration *are less than that seen in the well nourished* patient following trauma of similar degree The tissue losses sustained by the patient in Fig 1-9*B* following operation are offset by the pronounced retention of water mainly in the extracellular compartment which she sustained during *the first two stages of re*covery This observation was confirmed clinically by the appearance of pitting edema during this period of convalescence When the depleted patient is subjected to lesser degrees of operative trauma than the example under discussion the conservation of body tissue is more apparent Nevertheless the gross retention of water and salt for a more protracted period of recovery is a characteristic of the depleted patient s response to injury

The depleted patient s tenacity of water in the immediate recovery period is one characteristic which makes his management difficult The hyperhydremia of the e patients may be sufficient to lower the osmolarity of their serum Ordinarily, in the untraumatized patient this drop in osmolarity would be an adequate stimulus to induce diuresis This stimulus does not hold in the *postinjury de*pleted patient Further, any attempt at raising the osmolarity to normal may be conducive to pulmonary edema The correct approach to this problem in convalescence is to restrict fluid This restriction should be main*tained until the patient is* able to take oral feedings containing sufficient calories and protein to balance the depletion Once restoration of the nutritional state is started the problems of retained fluid will take care of themselves with the ensuing diuresis Patients who require operation in the depleted state are especially susceptible to complications of an infectious nature This is an added reason for attempting repair of the deficiency before surgery When the pathologic process precludes the use of the gastrointestinal tract to accomplish this repair the intravenous route may be used efficiently Protein hydrolysates hexose solutions and to a limited extent fat emulsions may be used to aid in the repair of the patient s nutrition by the intravenous route This type of forced alimentation may be carried through operation with a reasonable amount of success The authors experience with forced feeding has been reported in detail elsewhere but the feeding program has been most successful in the depleted patient prior to operation

The final significant factor which exerts a considerable influence on the quantitative nature of the metabolic sequence following trauma is the occurrence of major complications during the recovery period In Fig 1 10 *is shown the metabolic* balance and cumulative change charts of a white woman of geriatric age who was admitted because of a small gastric neoplasm As far as could be determined she was not depleted prior to operation As may be seen from the charts *in Fig 1 10 convalescence from* the total gastrectomy was progressing well until the fourth day following operation when diar



A

Fig 1 10 *A* The metabolic chart on patient contracting pseudomembranous enterocolitis following total gastrectomy

they developed Shortly thereafter it was established that the patient had contracted pseudomembranous enterocolitis secondary to a resistant strain of hemolytic staphylococcus Only the most heroic treatment employing intensive antibiotic therapy with the administration of large doses of ACTH succeeded in pulling this patient through her protracted convalescence A glance at Fig 1 10*A* shows in the nitrogen balance chart that the occurrence of the second insult pushed the patient back into the severe catabolic state noted immediately following operation Only after her treatment became effective 2 days later did she pass into the second stage of recovery that of lessening depletion The extraordinary water shifts associated with the complication and its treatment are

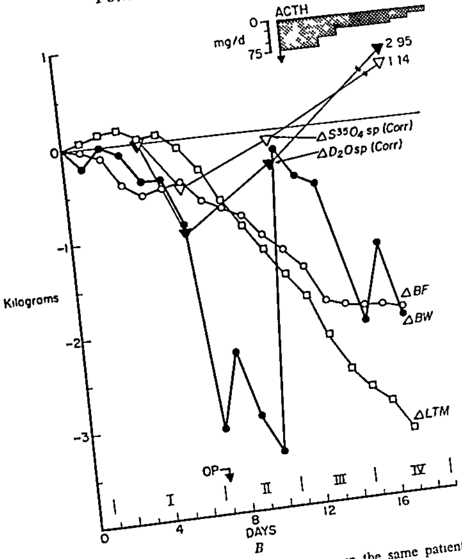


Fig 1 10 *B* Alterations in body components in the same patient

brought out in Fig 1-10*B* Unfortunately, however the study on this patient had to be terminated before she had reached the anabolic stage of recovery Close clinical observation on the patient after the termination of the study showed her to progress in an orderly fashion through the remaining stages of recovery At this writing the patient is alive and doing her own housework

Within the lesser degrees of trauma such as those represented by resections for benign lesions of the stomach and intestine there appears to be a quantitative difference in the nature of the metabolic sequence following operation between male and female From the information available it appears that this is another example of the weaker sex surviving trauma of intermediate degree with a shorter period of endogenous catabolism than the male patient sustaining the same degree of operative trauma When the more severe degrees of trauma such as those incurred by extensive radical procedures designed to eradicate tumor are studied for differences in the quantitative response between men and women these sexual differences in response are less apparent

CONCLUSIONS

In outlining the foregoing material the authors have studiously avoided theoretical

discussion of why the metabolic sequence occurs following injury This was done because studies on the influence of various hormones on the metabolic response are at present confusing and because the entire field of endocrinology as it pertains to surgical convalescence is in a state of flux Much more study must be done in endocrinology and related fields before the true picture of the relationship between the glands of internal secretion and convalescence may be outlined with some certainty The authors have elected to present the information which has in their opinion stood up under careful scrutiny and which has come from studies in which they have been personally involved

The foregoing information indicates that the physiologic deficiencies commonly encountered in the geriatric patient may influence the degree and duration of the metabolic response to injury but the authors have yet to encounter a geriatric patient in whom the metabolic sequence following trauma differed qualitatively from that seen in younger adults subjected to similar degrees of trauma Biologically speaking the individual surviving to the geriatric age group has weathered many an injury and his survival to this age period denotes resiliency and fortitude which one is unable to measure adequately The geriatric patient may be carried through even the most severe degrees of trauma to a successful recovery when he is managed with precision insight and understanding

BIBLIOGRAPHY

Albanese A A Higgons R A Orto L Belmont A and DiLallo R Effect of Age on the Utilization of Various Carbohydrates by Man Metabolism 3 154 1954

Albert A Randall R V Smith R A and Johnson C E Urinary Excretion of Gonadotropin as a Function of Age in *Hormones and the Aging Process* Academic Press Inc New York 1956 p 49

Aub J C and Du Bois E F Clinical Calorimetry 19 The Basal Metabolism of Old Men Arch Int Med 19 823 1917

Bates D V and Christie R V Effects of Ageing on Respiratory Function in Man Ciba Colloquia on Ageing I 58 1955

Beal J M Cornell G N and Gilder H Factors Influencing Nitrogen Metabolism in Surgical Patients Surgery 36 468 1954

Black D A K Renal Function in Respiratory Failure Ciba Colloquia on Ageing 4 264 1958

Bland J H *Clinical Recognition and Management of Disturbances of Body Fluids* W B Saunders Company Philadelphia 1956 p 265

Bogdonoff M D Shock N W and Nichols M P Calcium Phosphorus Nitrogen and Potassium Balance Studies in the Aged Male J Gerontol 8 272 1953

Brozek J and Keys A Age Changes of Total Body Fat in Normal Adult Men Fed Proc 11 18 1952

Cope O Nardi G L Quijano M Rovit R I Stanbury J B and Wight A Metabolic Rate and Thyroid Function Following Acute Thermal Trauma in Man Ann Surg 137 165 1953

Cornell G N Gilder H Filippone A Fuller F W and Beal J M Changes in Body Compartments Following Operation Surgery 44 125 1958

Cornell G N Gilder H Mannix H Jr and Beal J M Studies of Caloric Nitrogen and Electrolyte Requirements in Decreasing Post-operative Nitrogen Loss S Forum 5 450 1954

Corsa L Jr Olney J M Jr Steenburg R W Ball M R and Moore F D The Measurement of Exchangeable Potassium in Man by Isotope Dilution J Clin Invest 29 1280 1950

Davies D F Age and Osmotic Work in Urea Excretion Fed Proc 8 32 1949

Davies D F and Shock N W Age Changes in Glomerular Filtration Rate Effective Renal Plasma Flow and Tubular Excretory Capacity in Adult Males J Clin Invest 29 496 1950

Duncan L E Jr Solomon D H Rosenberg E K Nichols M P and Shock N W The Metabolic and Hematological Effects of the Chronic Administration of ACTH to Young and Old Men J Gerontol 7 351 1952

Goodman J I Nutrition Life Tenure and the Degenerative Diseases Geriatrics 13 *359 1958*

Hayes M A Williamson R J and Heidenreich W F Endocrine Mechanisms Involved in Water and Sodium Metabolism during Operation and Convalescence Surgery *41 353 1957*

Heller E J Heller C G and Sevringhaus E L Gonadotropic Hormone Assays of Human Male Urine Endocrinology 29 1 1941

Hilton J G Goodbody M F Jr and Kruesi O R *The Effect of Prolonged Administration of Ammonium Chloride on the Blood Acid Base Equilibrium of Geriatric Subjects* J Am Geriatrics Soc 3 697 1955

Kise Y and Ochi T Basal Metabolism of Old People J Lab & Clin Med 19 1073 *1934*

Krieger H Abbott W E Levey S and Holden W D Re evaluation of the Role of the Adrenal and Other Factors in the Metabolic Response to Surgery Surgery 44 *138 1958*

Landowne M Methods and Limitations in Studies of Human Organ System Function Ciba Colloquia on Ageing 3 73 1957

Lewis A Mental Aspects of Ageing Ciba Colloquia on Ageing 1 32 1955

Lewis W H Jr and Alving A S Changes with Age in the Renal Function in Adult Men Am J Physiol 123 500 1938

Miller J H and Shock N W Age Differences in the Renal Tubular Response to Antidiuretic Hormone J Gerontol 8 446 *1953*

Moore F D Bodily Changes in Surgical Convalescence *Ann Surg 137 289 1953*

Moore F D Endocrine Changes after Anesthesia Surgery and Unanesthetized Trauma *in* Man Recent Progr Hormone Res 13 511 1957

Moore F D Common Patterns of Water and Electrolyte Change in Injury Surgery and Disease New *England J Med* 258 277 1958

Moore F D Metabolism in *Trauma The* Meaning of Definitive Surgery in *The Wound The Endocrine Glands and Metabolism The Harvey Lectures 1956–1957* Academic Press Inc New York 1958 p 74

Moore R A The Total Number of Glomeruli in the Normal Human Kidney Anat Rec 48 153 1931

Norris A H Shock N W Landowne M and Falzone J A Jr Pulmonary Function *Studies Age Differences in Lung Volume* and Bellows Function J Gerontol 11 379 *1956*

Norris A H Yiengst M J and Shock N W Age Differences in Respiratory Ventilation and Oxygen Consumption Following Standardized Exercise Fed Proc 10 98 *1951*

Parker H V Oleson K H McMurrey J and Friis Hansen B Body Water Compartments throughout the Lifespan Ciba Colloquia on Ageing 4 102 1958

Paquin A J The Rate of Body Weight Loss Following Surgical Stress of Uniform Intensity Ann *Surg 141 383 1955*

Paquin A J Insensible Weight Loss Following Uniform Severe Surgical Trauma Ann Surg *148 937 1958*

Paquin A J Gilder H Wyker A and Beal J M *Body Weight and Water Balance* Metabolism 8 16 1959

Paquin A J and Lange J *Studies on Post* operative Weight Loss Ann Surg 144 809 1956

Pincus G Dorfman R I *Romanoff L P* Rubin B L Bloch E Carlo J and Freeman H *Steroid Metabolism in Aging Men* and Women Recent Progr Hormone Res 11 307 1955

Rawson R W The Thyroid in the Ageing Process in *Hormones and the Aging Process* Academic Press Inc New York 1956 p 39

Rubin B L Dorfman R I and Pincus G 17 Ketosteroid Excretion in Ageing Subjects *Ciba Foundation Colloquia on Ageing* 1 126 1955

Sagild U Total Exchangeable Potassium in Normal Subjects with Special Reference to Changes with Age Scandinav *J Clin &* Lab Invest *8 4450 1956*

Samuels L T Effect of Ageing on the Steroid Metabolism as Reflected in Plasma Levels *in Hormones and the Aging Process Academic Press Inc* New York 1956 p 21

Schmidt I A *III Iob V Flotte C T* Hodgson P E and McMath B S Blood

Volume Changes in the Aged Surgery 40 939 1956

Shock N W Some Physiological and Biochemical Aspects of Ageing in *Symposium on Problems of Gerontology* Nutrition Symposium Series No 9 National Vitamin Foundation Inc 1954 p 1

Shock N W The Role of the Kidney in Electrolyte and Water Regulation in the Aged Ciba Colloquia on Ageing 4 229 1958

Shock N W Yiengst M J and Watkin D M Age Change in Body Water and Its Relationship to Basal Oxygen Consumption in Males J Gerontol 8 388 1953

Silverstone F A Brandfonbrener M Shock M W and Yienst M J Age Differences in the Intravenous Glucose Tolerance Tests and the Response to Insulin J Clin Invest 36 504 1957

Sims E A H Welt L G, Orloff J and Needham J W Asymptomatic Hyponatremia in Pulmonary Tuberculosis J Clin Invest 29 1545 1950

Smith I E Glucose Tolerance in the Aged J Gerontol 3 66 1948

Solomon D H and Shock N W Studies of Adrenal Cortical and Anterior Pituitary Function in Elderly Men J Gerontol 5 302 1950

Taran L M and Szilagyi N Electrocardiographic Changes with Advancing Age Geriatrics 13 352 1958

Tyler F H Eik nes K Sandberg A A Florentin A A and Samuels L T Adrenocortical Capacity and the Metabolism of Cortisol in Elderly Patients J Am Geriatrics Soc 3 79 1955

2

Surgical Infections

Peter Dineen

Infection in the aged may follow the same course as in younger individuals. However, it is common for an older patient with a severe or overwhelming infection to show little systemic reaction. This false harbinger of well-being may lead to disastrous results. Charcot in his lectures emphasized this point repeatedly.

Although cardiovascular disease is the leading cause of death in persons over 50 years of age (Medalia and White), Mueller-Deham pointed out the discrepancies between the clinical diagnosis of cause of death and the actual autopsy findings at Goldwater Hospital. He made the statement that deaths from cardiovascular disease are overestimated (by clinical diagnosis) and those from infection underestimated. There is reliable evidence from the author's own experience to confirm this general lack of reaction to infection by elderly patients which leads to a failure in diagnosis.

While infection in older individuals may not be associated with fever, chills, tachycardia, pain, or other symptoms, it usually provides some clue to its presence to the careful observer. When a suspicion of infection arises, every effort should be made to find its source and to treat it vigorously. Although elderly patients may not manifest severe systemic reaction, this does not mean that the infection is an insignificant one. In many cases it may be severe and even fatal. Pratt pointed out the great difficulty in making the diagnosis and the importance of having a high index of suspicion. Homburger stated that in a series of 73 deaths in patients over 65, the diagnosis of pulmonary infection was made clinically only 19 times but the condition was found at postmortem examination 54 times.

ETIOLOGY

The causative agents of surgical infections among the elderly are similar to those in younger patients. The enteric organisms (*Escherichia coli*, *Aerobacter aerogenes*, *Pseudomonas aeruginosa*, *Proteus vulgaris*, enterococci, *Clostridium perfringens*, and many others), staphylococci, and streptococci account for the vast majority of infections. Less commonly a more specific infection may be present, as for example tuberculosis, tetanus, or fungus diseases.

The enteric organisms and staphylococci are the most important offenders. In specific organ infections (acute cholecystitis or acute appendicitis) one or both of these microbial groups may be represented. Postoperative wound infections are about equally distributed between them. Infections of the skin are predominantly staphylococcal, but in areas of decreased blood supply, for example diabetic ulcer of the foot, enteric organisms may also flourish.

Although infections in various areas generally follow certain local "ground rules," the diseases caused by enteric organisms share certain things in common, as do those caused by staphylococci and streptococci.

PATHOGENESIS

The factors which influence the course of an infection are usually given as the virulence of the organisms and the resistance of the host In old age infection occurs not because of increased microbial virulence but because of diminished host resistance The host resistance is not less in a measurable immunologic manner except in very advanced debility but rather because of specific localized anatomic deficits (Rantz) For example in arterial insufficiency with incipient gangrene of the lower extremity the ability of this area to combat an infection even by low grade pathogens is very slight In long standing pulmonary emphysema the lung itself is more susceptible to bronchopneumonia if the organisms are delivered to it as in aspiration after anesthesia Thus these specific anatomic defects may allow infection to occur

Similarly physiologic abnormalities may lay the groundwork for infection For example since insulin has now been in use for over 30 years many diabetics are achieving old age despite severe disease All patients with diabetes are potentially good hosts to bacteria and any small break in the defense line for example an ingrown toenail may lead to disaster

The virulence of bacteria varies The *hemolytic Staphylococcus aureus* has many strains all of which are basically capable of initiating a severe infection in viable tissue if a large enough inoculum is present There are indications however that certain epidemic strains (phage type 80–81) may be more virulent than others or at least much more readily transmissible

The beta hemolytic streptococcus can cause severe infections such as cellulitis lymphangitis lymphadenitis and bacteremia in a very few hours This organism does not require a large inoculum to get started and can carry on its lethal course in the presence of viable tissue

The enteric organisms are almost saprophytic They do not have adequate proteolytic enzymes and consequently depend for their pabulum on the breakdown products of dead or dying tissue The proteolytic enzymes released in this manner by dead leukocytes or living staphylococci break down the large molecules to a form that can be utilized by these enteric organisms

TYPES OF INFECTION

The types of surgical infection seen in the aged can be divided into a primary group and a secondary group The primary infections are those which bring the patient to the surgeon because of the nature of the disease e g acute cholecystitis or conjunctivitis The secondary infections are those which arise as a complication of another disease or a complication of treatment e g diabetic gangrene postoperative wound infection or pseudomembranous enterocolitis Some specific examples of both types will be given in a later section of this chapter

Both these types may be caused either by the enteric group of organisms or by the staphylococci Among infections arising in the hospital those caused by staphylococci are usually more difficult to manage because the organisms are usually resistant to penicillin the tetracyclines and many other chemotherapeutic agents

DIAGNOSIS

It is trite to say that the diagnosis of infection in the aged depends on taking it into account in the differential diagnosis in the first place However since infection may be proceeding at a rapid and uninhibited rate despite outward signs of well being its presence must always be considered Some infections will be quite readily recognized others will not In obvious infections such as open wounds gangrene or pustular eruptions the organism should be identified by standard laboratory procedures to assist in the proper treatment both by local means and by systemic chemotherapy First a smear of the area should be made placed on a glass slide

and stained by Gram s method This will give *valuable* information because the physician will know the general group of organisms with which he is dealing For example if the slide reveals many Gram negative rods as well as Gram positive rods and cocci, he may reasonably assume that the wound con tains the enteric group of organisms This is immediately helpful *in treatment* as we will see If the slide shows predominantly cocci of the Gram positive type the infection is either streptococcal or staphylococcal (The *chain morphologic characteristic of* strepto cocci usually are not present on a smear from a nonliquid source)

After a smear has been made a specimen should be used to inoculate culture media If possible this should include blood agar plate beef infusion broth and some an aerobic media—either liver dextrose broth or incubation of a blood agar plate in a carbon dioxide atmosphere This type of cul turing allows for separate and complete bac-teriologic diagnosis This may take at least 48 hours and perhaps twice as long Never-theless it is important to document each case in this manner Although treatment is *usually started before the culture results are* available the subsequent report of the or ganisms originally present will be helpful if progress is unsatisfactory or in deciding how long to continue therapy

Since the pathogenesis of many if not all infections involves both the bacteria and the host resistance the diagnosis and treatment *are incomplete if they consider only the bac* teriologic aspects The second step in the diagnosis of an infection is to determine whether or not an anatomic or physiologic deficit exists in the host Such obvious con ditions as renal calculi arterial insufficiency diabetes mellitus or cirrhosis may be pres ent The eventual treatment of the infection will involve attacking these problems

When an elderly patient has some rather vague complaints associated with a few ob-jective findings the surgeon must search dili gently for the cause For *example a man of* 80 complains of a sore back and has a slight fever and tachycardia Examination of the urine shows a few white cells and there is a slight leukocytosis The patient is hospital ized a blood culture reveals *E coli* and an intravenous *pyelogram shows nonfunction of* one kidney due to a calculus obstructing the renal pelvis After the reestablishment of urinary drainage the patient rapidly im *proves*

Careful search must be made for infection and if there is no obvious source certain routine procedures should be done These in *clude* urinalysis with culture and microscopic examination of the sediment complete blood count blood culture intravenous pyelogram chest x ray sputum examination stool cul tures and dental evaluation In the postoper ative patient consideration must be given to infection in the urinary tract lungs and wound An elderly patient who has gone through a major operative procedure may begin to fail in the first week after surgery To explain this it is not unusual to hear such statements as The operation was just too much for the old man or His heart couldn t take it or All his reserves were depleted These platitudes express only our *ignorance and very often the postmortem* examination will reveal advanced pyelone phritis or purulent bronchitis conditions which are reasonably responsive to adequate *treatment if the diagnosis is made*

TREATMENT

Once the diagnosis of infection has been made treatment should be started vigorously There is nothing more dangerous in the management of infections than inadequate *treatment This permits drug resistance* to emerge in the microbial population Incom plete treatment of the host s anatomic deficit e g incomplete debridement leaves the bac *teria with a satisfactory foothold*

The basic principles of the treatment of infection pertain These include the evacua tion of purulent material and the establish *ment of adequate drainage* Specific local therapy such as heat elevation and im

mobilization is still important in acute infections with severe inflammation but it must be used judiciously in the aged

Treatment is divided into two parts The specific antimicrobial measures are selected on the basis of the smears made and stained by Gram s method and these may be modified when the culture and drug susceptibility tests are reported Generally Gram s stain provides a great deal of information about the infection and indicates certain drugs that may be used If Gram s stain reveals predominantly Gram positive cocci one is confronted with either a streptococcal or a staphylococcal infection in the vast majority of cases The surgeon then is justified in selecting an antimicrobial agent if the seriousness of the patient s condition and the lack of localization indicate its use Since beta hemolytic streptococci are susceptible to penicillin and to most of the other antimicrobials the selection will depend on the *Staphylococcus* If the infection is a postoperative one or one which arose in the hospital the chances are very good that the organism is resistant to penicillin and the tetracyclines Consequently some agent to which most of the local hospital staphylococci have been susceptible in the past is used In an effort to prevent the emergence of resistance or to potentiate the action of the agent it may reasonably be combined with streptomycin If this is done the toxicity of streptomycin must be kept in mind

If Gram s stain shows mainly Gram negative rods, then the assumption is that the infection is caused by the enteric organisms probably a mixture of several different types some of which are resistant to most if not all antimicrobials Since these organisms are mainly low grade pathogens which depend on the presence of a pathologic condition in the host treatment should be directed to treating this underlying condition This may consist of removal of an obstructing renal calculus adequate debridement removal of a foreign body or similar corrections

Antimicrobial drugs in this type of infection are not as specific or as helpful as they are in the Gram positive infection However on occasions when the low grade pathogens of the enteric group of organisms establish an infection in a debilitated patient or when the infection is quite extensive the bacteria may enter the blood stream in large numbers and set up foci in other organs especially the lung To prevent this and to help contain these infections antimicrobials are given Usually streptomycin is the drug of choice and this may be combined with penicillin or one of the broad spectrum agents either chloramphenicol or tetracycline Some organisms in this group are penicillin sensitive especially the clostridia

The absence of normal renal function is an important factor in the treatment of elderly persons with any of the antimicrobial agents However with the tetracyclines this is not as serious, since the major portion of this drug is excreted by the liver in the bile Poor renal function on the basis of poor tubular absorption accounts for consistently higher blood levels of the remaining drugs This is probably an advantage in the use of penicillin which is practically never toxic With streptomycin bacitracin polymyxin and neomycin and the less toxic novobiocin chloramphenicol and erythromycin higher blood levels may be dangerous Since blood assays to determine the amount of circulating drug are time consuming this is not a practical way to regulate dosage The lower amounts within the suggested dosage range of a drug should be used For example if the recommended dose of streptomycin is 1 to 2 Gm each day in the elderly patient one should favor the lower dose This should be accompanied by vigilance for signs of drug toxicity including frequent urine sediment microscopy studies for signs of renal damage and attention to the central nervous system particularly eighth nerve function The specific drug toxicities will be discussed with each drug

Drug Susceptibility (Sensitivity) Tests

The purpose of this test is to determine which of many antimicrobial agents is most

effective against any one bacterial species This test has many practical limitations which restrict its clinical usefulness There are two types of susceptibility tests The first utilizes small disks impregnated with a known amount of drug From one to three disks with varying drug strength may be used for each antimicrobial These are placed on agar plates which have just been streaked with the specific organism to be tested The plates are incubated and examined 24 hours later The drug selection is based on areas of in hibition surrounding the var ous disks This test has many obvious weaknesses The bacteria under study are in an artificial labora tory medium not in vivo If there is more than one organism in the original culture each must be tested separately This is not very reliable because it does not take into account the common factor of interdepend ence among bacterial species For example if one of the organisms is penicillin sus ceptible this drug might be added to the antimicrobial regimen However the other organism may produce penicillinase which will completely protect the penicillin-sus ceptible bacteria when they are existing to gether The test takes 24 hours and this is added to the time necessary for primary iso lation Lastly the disks themselves contain inaccurate amounts of the drug and will give erroneous impressions based on varying dif fusibility into the agar medium Thus chlor-amphenicol always has a large zone around the disk, which means only that it is more soluble and diffusible in agar than most of the other agents

The second type of susceptibility test is the tube dilution method This is commonly done in the manner described by Rammel kamp This is a more accurate test and de pends on serial dilution of antimicrobial agents with a constant amount of broth cul ture of the organism under study This is an excellent research tool and is extremely help ful in serious staphylococcal or (nontype A) streptococcal infections Because it also is an in vitro test with all the limitations thereof the test is of less clinical value in other types of infection It takes several days for pri mary isolation and finally the test itself must be done To test one organism in this manner against 10 standard drugs would require about 160 tubes Consequently this test has limited practical application in a busy service laboratory

To summarize these tests are of limited value *One should not wait for their results before starting therapy and one should not alter what appears to be successful treatment merely because an in vitro test does not agree with the in vivo situation* They are particu larly useful in instances of resistant staphylo coccal infection subacute bacterial endocar ditis and other protracted infections

SPECIFIC SURGICAL INFECTIONS

Although all surgical infections cannot be covered in the space of this chapter examples have been selected which illustrate the problems peculiar to the major systems of the body

Skin and Subcutaneous Tissue

Some of the most frequently encountered infections of this area are boils and car buncles In almost all cases the etiologic agent is the hemolytic *Staphylococcus aureus* The disease stems mainly from the virulence of the organism and much less from any anatomic or physiologic defect The diag nosis is self evident on inspection Treatment of the local lesion should be surgical with evacuation of the purulent material but spe cific procedures depend on their localization and size Antimicrobial agents have no place in the treatment of localized staphylococcal infections for two reasons (1) often the in flammatory wall is such that antimicrobials cannot pass this barrier (2) if they do pass they may be ineffective because of the in ability of the leukocytes to kill the staphylo cocci even after phagocytosis The only real justification for using any antimicrobial in

this type of infection is to prevent spread of the disease by blood lymph or direct extension This would only occur in a very large carbuncle or boil where there is evident cellulitis and a suggestion of poor confinement or where the lesion is located in a dangerous area e g nasolabial area on the nose or beneath the eye Poor localization is usually associated with an elevation of the temperature and a tachycardia A smear and culture of any exudate should be made and if this shows Gram positive cocci several choices of chemotherapy are available Almost all of the antimicrobial agents are effective against some strains of staphylococci If the infection started at home and the patient has received no previous drugs for the treatment of this disease there is at least a 60 per cent chance that the organism is penicillin sensitive and an almost 100 per cent chance that it is sensitive to the other drugs The decision as to which drug to use and whether to give it parenterally or orally will be governed by the individual case A good selection and one which has been effective at Cornell Medical Center is erythromycin 1 to 2 Gm per day in divided doses either by mouth or intravenously This should be continued until all evidence of systemic reaction or local severe cellulitis has subsided Once adequate drainage is established there usually is very little need for continuing the drugs

Erysipelas a skin infection caused by group A hemolytic streptococci should be treated with penicillin The usual dosage is 600 000 to 1 200 000 units of procaine penicillin intramuscularly each day in divided doses This should be continued until the patient is afebrile for at least 48 to 72 hours In penicillin sensitive patients sulfadiazine 1 Gm every 4 hours will be satisfactory Adequate hydration and alkalinity of the urine must be obtained by the use of sodium bicarbonate 2 Gm for each 1 Gm of sulfonamide The newer sulfonamides (Gantrisin and Elkosin) are more soluble However since all sulfonamides are excreted almost exclusively by way of the kidneys and since renal function may be less efficient in older persons dangerous levels may be built up in the blood

Central Nervous System

Localized surgical infections do occur particularly in the form of brain abscess osteomyelitis of the vertebrae with extension into the spinal canal and other less common situations Attention is directed to these lesions because of the central nervous system symptoms that they cause rather than because of signs of infection per se Here again the treatment is surgical to evacuate the pus and to decompress the brain or spinal cord Once this has been done it is important to prevent a new infection from establishing itself Frequently these infections are staphylococcal in origin but they may be caused by the enteric group of organisms

If infection is suspected preoperatively procaine penicillin 300 000 units and streptomycin 0 5 Gm should be given intramuscularly This gives a broad coverage by bactericidal drugs At the time of operation when the purulent material is smeared and cultured more specific information will be available However unless the clinical course warrents a change the original agents should be continued If the offending organism is a penicillin resistant *Staphylococcus* then erythromycin or novobiocin may be substituted

Sinusitis

Infection of the paranasal sinuses is usually associated with the viral upper respiratory tract infections When however sinus drainage becomes purulent or one sinus becomes tender bacterial infection has probably supervened In this case the organism should be identified Simultaneously the standard surgical principle of adequate drainage should be applied

Since the majority of bacterial sinusitis is caused by Gram positive cocci they usually respond satisfactorily to penicillin 300 000

units twice a day or tetracycline, 250 mg every 4 to 6 hours

Oral Infection (Ludwig's Angina)

This severe and widespread cellulitis of the floor of the mouth is much less common now than previously However, this disease may occur in elderly individuals with poor oral hygiene who often put off seeking medical care It is usually caused by the beta hemolytic streptococcus and is rapidly progressive involving the floor of the mouth and then the pterygoid space Since there is little purulent material surgical drainage is not always satisfactory Massive antimicrobial treatment should be used This consists of one million units of aqueous penicillin every 2 hours plus 1 Gm of streptomycin twice a day As soon as the infection begins to subside the penicillin can be reduced to 600 000 units of procaine penicillin every 6 hours and in succeeding days the dosage of both drugs can be tapered off However, they should be continued until all palpable induration has subsided

Perforated Esophagus with Mediastinitis

Bacteriologically it does not make much difference whether the perforation is high or low or whether it is due to intrinsic disease such as carcinoma cardiospasm or scleroderma or to trauma such as that caused by esophagoscope or dilator

The surgical treatment of course will be dictated by the lesion its course and its position In a simple perforation of an esophagus from within by instrumentation it may be possible to treat the patient by rest nothing by mouth and massive chemotherapy Once definite localized mediastinitis has occurred however mediastinal drainage will have to be performed In any event whenever the esophagus is perforated organisms of the upper gastrointestinal tract invade the mediastinum These include nonhemolytic streptococci anaerobic streptococci some Gram negative enteric organisms and the *Corynebacterium diphtheroides* group Some more virulent organisms may be present However, these low grade pathogens attack the mediastinum quite avidly, since it has a very low bacterial resistance If the source of bacteria remains open (e g a perforated carcinoma or broken down suture line) the infection will not be controlled by drugs alone If, however the perforation has closed over, the antimicrobial agents may be sufficient Again massive therapy is indicated and this should consist of aqueous penicillin, one million units every 2 hours and streptomycin 1 Gm every 12 hours This high dosage should be continued in the presence of an otherwise satisfactory course for a minimum of 48 hours and then gradually reduced over a period of 10 days to 2 weeks

Lung Abscess

Abscess formation following pneumococcal pneumonia is much less common than it has been However it does occur and also is seen occasionally after staphylococcal or *Klebsiella* pneumonias Frequently a lung abscess is associated with bronchial obstruction caused either by a foreign body or by a tumor The lung abscess as it is seen today usually contains a mixed flora until the antimicrobial drugs are used After this usually only staphylococci of the resistant hospital variety are recovered Probably the original etiologic agents in these cases are the same as those that caused the predisposing condition i e the pneumonia

The diagnosis is made by physical findings and x ray examination A bacteriologic diagnosis is not made unless conservative therapy fails and the area must be resected Culture of the sputum produced may be helpful in indicating the presence or predominance of staphylococci, pneumococci or *Klebsiella* These cultures obviously contain organisms from the nasopharynx and on artificial media these may greatly outgrow the true pathogen It is important not only to diagnose the lung abscess bacteriologically but also to diagnose the underlying defect in the lung which allowed the lesion to develop The lung abscess may simply be the result

of tissue breakdown subsequent to a severe local inflammatory process (pneumonia) However, it may represent necrotic and infected tumor or tissue peripheral to an obstructing carcinoma The treatment of lung abscess in those cases associated with tumor is the treatment of the underlying disease

With the advent of drug therapy there have been fewer lung abscesses and these have responded well to the antimicrobial agents in a high proportion of cases

The drugs of choice depend to a certain extent on the organisms present but often these cannot be positively identified However penicillin has been shown to be effective probably because a high proportion of the abscesses contain Gram positive cocci and rods A regimen that is usually successful in procaine penicillin 600 000 units every 8 hours and streptomycin 0 5 Gm twice a day This should be continued until the cavity is closed If the patient has a high fever and is quite toxic when treatment is begun the dose of penicillin may be increased up to one or two million units every 2 hours This should be continued until the patient s temperature and pulse begin to approach the normal range At that time one may start the regimen previously mentioned Local therapy either by injection or aerosol inhalation does not seem to be demonstrably effective in comparison to parenteral therapy

An alternative form of therapy utilizes one of the broad spectrum agents either tetracycline or chloramphenicol by mouth depending on how well the drug is tolerated A suggested dosage is 2 Gm per day in divided doses As clinical improvement occurs this may be gradually reduced

Tuberculosis

It is not within the scope of this text to discuss the diagnosis and treatment of tuberculosis Suffice it to say that Cornell Medical Center now favors triple drug therapy of isoniazid paraaminosalicylic acid and streptomycin This applies to tuberculosis in almost any location Surgery as indicated is carried out

Perforated Peptic Ulcer

In the first few hours following perforation culture of peritoneal contents will usually show no growth Younger persons often do not receive any antimicrobials postoperatively Older patients are given drugs because of the pulmonary complications which may arise When in an older (emphysematous) patient the diaphragm has been splinted as occurs in peritonitis the bronchial secretions tend to stagnate in the lower lobes This material is usually chronically infected When it is not cleared by adequate breathing or coughing the streptococci staphylococci and corynebacteria rapidly multiply They cause further bronchial wall infection and a serious purulent bronchitis may occur in a few days followed by pneumonia and hypoxia The effects of chronic hypoxia eventually bring on collapse To prevent this complication the patient is started on penicillin (procaine) 600 000 units and streptomycin 0 5 Gm both twice a day This should be continued until the patient is fully ambulatory and afebrile

If the perforation of the stomach or duodenum has been present several hours organisms of the esophagus and jejunum will migrate to the site of perforation and then into the free fluid of the peritoneum By this time the acidity has been neutralized and the bacteria begin to multiply After about 12 hours they are quite numerous and a definite bacterial peritonitis is taking form By 24 hours a purulent severe bacterial peritonitis has developed The patient is given massive drug therapy combined with active surgical treatment All the enteric organisms may be represented plus staphylococci and the streptococci of the nonhemolytic type It is the author s policy to use the bactericidal drugs under these circumstances Consequently the patient receives approximately 25 million units of penicillin and 2 Gm streptomycin per day Adequate and heavy dosage seems more reliable than a mixture of several drugs If one so desires chloramphenicol (1 to 2 Gm per day) may be given parenterally Erythromycin (1 to 2 Gm per

day intravenously) or bacitracin (10,000 to 20 000 units every 6 hours intravenously) may be substituted for penicillin

When the peritoneum is open, at the time of operation all infected material is aspirated Following this but before closing it is the author s practice to instill 1 Gm neomycin sulfate dissolved in 100 cc of distilled water This is left in place as the wound is closed At this concentration neomycin is bactericidal to almost all organisms (and indeed is a solution used for the cold sterilization of instruments) If no more than 1 Gm is used the chances of any toxic manifestations are extremely unlikely

Perforated Diverticulitis or Carcinoma

Once the patient is seen in the emergency room and the diagnosis is made antimicrobial therapy is started immediately Since this is either a generalized or localized peritonitis caused by enteric organisms the choice of drugs again falls to penicillin and streptomycin The usual surgical procedure of transverse colostomy is carried out frequently with drainage of the pelvis or left iliac fossa area The degree of peritonitis the length of the interval between colostomy and definitive surgery and the prevention of fistula formation may all be favorably influenced by the use of the antimicrobials Procaine penicillin 600 000 units and streptomycin 0 5 Gm every 6 to 8 hours are given initially After this the dose is given every 12 hours This should continue until no systemic or local signs of infection remain usually about 2 to 3 weeks Neomycin 1 Gm is used locally here as well

Perforated Appendix

This disease is frequently fatal among older persons Accurate diagnosis and prompt surgery are essential The peritonitis is treated locally with 1 Gm of intraperitoneal neomycin along with penicillin 600 000 units and streptomycin 0 5 Gm every 6 hours As clinical improvement occurs this may be reduced

Urinary Tract Infections

These diseases are common in older age and cause a high incidence of morbidity and mortality among the elderly There is no better example than the urinary tract in all the study of infection Over 90 per cent of all infections in this area are caused by low grade pathogens arising from the enteric tract These organisms are able to cause disease because of a pathologic process in the urinary tract that permits urinary stasis It is extremely difficult to establish an infection in a smoothly functioning and intact urinary system However once there is obstruction or destruction of the protective physiologic valve systems infection is almost inevitable From this it would seem obvious that the treatment of urinary tract infections depends on whether the patient has a condition remediable by the urologist It is folly to treat with drugs alone a patient with an obstructed bladder neck and infected urine The only thing one can accomplish is removal of whatever sensitive organisms are present thus setting the stage for resistant microbes to take over This type of therapy can go on until one runs out of antimicrobials

However corrective surgery should be combined with active treatment of the urinary tract infections Among the effective drugs for a majority of these infections is sulfisoxazole (Gantrisin) 6 to 10 Gm per day in divided doses by mouth This drug is bactericidal to most of the organisms encountered except *P vulgaris* and *Ps aeruginosa* (*pyocyanea*) It is helpful in keeping chronic urinary tract infections in a relatively dormant state Streptomycin 1 Gm per day also has a good general range of coverage but resistant strains occur quickly Tetracycline 1 Gm per day is moderately effective against most organisms This drug like Gantrisin is useful in keeping urinary tract infections under control while not really curing them Chloramphenicol 2 Gm per day has about the same action as tetracycline but may be combined with the latter in severe infections Under these circumstances there

seems to be some potentiation of effect of both drugs

Nitrofurantoin (Furadantin 1 Gm per day) is a wide spectrum relatively nontoxic drug useful in most urinary tract infections especially those caused by the more resistant organisms e g *P vulgaris* Polymyxin B 2 5 mg per kg per day is a very nephrotoxic drug It is effective against *Ps aeruginosa (pyocyanea)* infections but should be used with great caution with frequent observations for nitrogen retention

Acute Cholecystitis

While the etiologic agent of the infection in acute cholecystitis is usually one or more of the enteric organisms commonly *E coli* the bacteria play a secondary role to the underlying disease process Because the lumen of the gallbladder is usually obstructed no bile enters it from the common duct Since there are focal areas of ischemia and even necrosis the blood supply to part or all of the organ may be very poor The result is that with increasing inflammation swelling and edema the gallbladder loses its ability to resist invasion by the microbes in the lumen

Immediate extirpation (cholecystectomy) or drainage (cholecystostomy) follows the general surgical principles of evacuation To treat this infection with drugs alone is courting disaster for these agents cannot be delivered to the entire gallbladder The areas of contiguous infection in the liver omentum etc can be partially controlled with the drugs but the actual site of the infection may remain relatively untouched Whether or not a detectable titer of antimicrobial can be demonstrated in the contents of an acutely inflamed gallbladder is not germane

It is not the routine practice at Cornell Medical Center to give drugs postoperatively to every patient with acute cholecystitis However in the older age group because of pulmonary complications and to help combat residual infection in the gallbladder bed in the liver procaine penicillin 300 000 units and streptomycin, 0 5 Gm, are given twice daily

Splenic Abscess

Although rare this disease may appear as the result of a bacteremia A septic infarct may occur which subsequently breaks down to form an abscess This disease should be managed by (1) treatment of specific bacteremia and (2) splenectomy The drugs chosen will depend on the organism involved

Diabetic Gangrene of the Lower Extremity

The bacterial invaders in diabetic gangrene often are a mixture of low grade pathogens (enteric organisms) saprophytes and sometimes staphylococci The underlying pathology of insufficient blood supply with consequent trophic changes associated with diabetes makes these patients extremely susceptible to infection There may be a dry gangrene with little or no infection localized suppuration only as in a diabetic ulcer or infection associated with progression and exudation or wet gangrene

In treating this disease it is important to attack the bacterial flora When either a local small operation or a radical amputation is done the organisms originally present may again endanger the operative area Of course of much greater importance is the basic defect in blood supply and secondary trophic changes The actual diagnosis that must be made is this Can the leg overcome the infection when one takes into account the poor blood supply diabetes and marked tissue wasting This decision is really difficult to make only when the infection is limited to the metatarsals and toes When the infection is spreading up the leg and into the muscle groups a high amputation will have to be performed

It is important that the operative procedure (whether a local debridement or amputation above the knee) results in a wound that has healthier walls i e better tissue and better blood supply Unless this is done the organisms of the original infection will

set up a locus in the new wound While some suggest that topical antimicrobial therapy be combined with enzymatic debridement in the author s experience, topical antimicrobials are generally of little use However in this situation one is dealing with almost pure saprophytes that are not invading living tissue markedly and topical drug therapy combined with enzymatic or mechanical debridement may be of some value A solution of 1 or 2 per cent neomycin applied four times a day is probably the most effective therapy This should be preceded by a period of application of enzymes to the wound At Cornell Medical Center streptokinase streptodornase, and plasminogen have been used with success

In general it is better to treat infections in such a manner that the blood carries the drug to the true battle site which is the ring of cells at the apparent edge or periphery of any infection The drugs recommended for the gangrenous leg infection are penicillin 300 000 units and streptomycin 0 5 Gm, twice a day Usually no more is needed, because the problem is not the lack of potency of the weapons but the inability to deliver them to the front lines

McLaughlin and Heider reported a study on this condition They stated that frequently in their experience patients with progressive wet gangrene were treated in a conservative manner Since the mortality increased with the length of preoperative hospital stay they strongly recommended early and adequate (radical) amputation This view corresponds with that of Cornell Medical Center After operation it is important to give antimicrobials because this is one situation where damaged tissue and poor host defense combine to make postamputation stump infection a very definite possibility Since the organisms originally involved in the infection have been identified by culture it is not difficult to select the correct drugs Usually these again will be penicillin 300 000 units and streptomycin 0 5 Gm twice a day

The following case demonstrates how infection in an amputation stump may be a fatal complication and how hemolytic *Staphylococcus aureus* can mimic gas gangrene

CASE REPORT J S (N Y H No 587891) A 74 year old white male was admitted to The New York Hospital in February 1957 He had a thrombosis of the right femoral artery and dry gangrene of the right leg A right supracondylar amputation was carried out He did well for about 1 week then he had a cerebrovascular accident The next day the stump was red indurated and showed much crepitus He was already receiving daily tetracycline A diagnosis of gas gangrene was made and a high amputation performed He received gas gangrene antitoxin one million units of penicillin every 2 hours and bacitracin locally He continued to do poorly developed pneumonia and died The cultures at operation and of the heart blood at autopsy revealed hemolytic *Staphylococcus aureus* highly resistant to penicillin It is of interest that this patient died from a severe staphylococcal infection which was superimposed on an advanced cardiovascular disease If staphylococcal infection had been suspected earlier perhaps a more favorable outcome would have occurred

CLOSTRIDIAL INFECTIONS

Tetanus is best prevented rather than treated and every person who has an injury with an open wound should be evaluated for immunization If the patient has not been actively immunized passive immunization with 1 500 units of antitoxin is performed after appropriate skin tests

In the older age group the disease is less common but also more often fatal The treatment consists of removing the source of toxin (local infection) along with general supportive measures These should of course include strict attention to the airway Muscle relaxants may be of help Large doses of antitoxin up to 100 000 units a day may be used to neutralize free toxin Penicillin is given in large doses (one million units every 2 hours) to combat the *Clos*

tridium tetani itself and also to prevent the establishment of a bacterial pneumonia

Gas gangrene is caused by one of several clostridia usually *Cl perfringens* or *Cl histolyticum* Others may be incriminated on occasions *Naturally this organism is an anaerobic* saprophyte a sporeformer and a normal inhabitant of the gastrointestinal tract Positive cultures for *Cl perfringens* from drain sites fistulas etc are frequent and should not lead one to believe that gas gangrene has appeared For this organism to cause disease there must be anaerobiosis necrotic material (usually dead muscle) and an opportunity to change from the spore state to the vegetative form This type of situation may occur with trauma and contamination an embolus in a large artery to an extremity or other similar situations Once the *Clostridium* starts to grow it will form toxins that are so noxious that they kill surrounding viable tissue and the bacteria quickly move in This infection can be extremely rapid and toxic The treatment is aimed at the Achilles heel of this organism namely its inability to survive in its vegetative form in an oxygen containing environment Therefore it is exposed to the air by extensive debridement and deep incisions into muscle Any halfway measures are useless and when an extremity is affected amputation is usually required Massive doses of penicillin (one to two million units every hour) are given but the organism is only moderately sensitive to this drug Gas gangrene antitoxin (made from the combined clostridial toxins of this group) may be used It is of questionable value since the major toxin action is local

Gas gangrene does not always follow trauma and in the aged it may be a complication of an underlying disease The following is a case report of an 81 year-old patient with carcinoma of the rectum and gas gangrene of the ischiorectal fossae

CASE REPORT J C (N Y H No 364902)

This patient was an 80-year-old white female admitted to The New York Hospital in June 1958 She had been having rectal bleeding for 1 year and had felt feverish and weak for 3 days Examination revealed a temperature of 38 C a constricting carcinoma of the rectum at about 1 in within the anus There was marked tenderness and induration of the ischiorectal areas Her white blood cell count was 34 000

During the next 48 hours the buttocks became very red and gangrenous areas appeared near the anus There was marked crepitation The patient received penicillin and streptomycin in usual doses the first day the second day nine million units of penicillin were given She failed to improve and a loop sigmoidostomy was performed with a wide debridement of the buttocks At the same time large doses (5 ampules i e 50 cc) of gas gangrene antitoxin were given Culture of wound was reported as *Cl perfringens* The patient responded favorably as regards clinical signs However she became obtunded and developed intractable pulmonary edema She died 1 month after the sigmoidostomy At autopsy there was no residual gas gangrene infection However there was a perforation of the rectum from the carcinoma which had allowed the infection to become established

COMMENT This infection actually was adequately treated by surgery and supportive drugs However the patient unfortunately did not survive because of heart failure

WOUND INFECTIONS (POSTOPERATIVE)

The experience of Cornell Medical Center in wound infections has been previously reported In general there is no apparent age or sex difference between the two large groups of wound infections i e those caused by staphylococci and those caused by enteric organisms The total number of infections involving enteric organisms is higher in the older age group but these are the patients who have the majority of colon surgery and contamination of lower body and extremity wounds (e g fecal contamination of an amputation stump)

Wound infections occur in the operating room when either virulent staphylococci car

ried by hospital personnel or enteric organisms from the patient s own intestinal tract are allowed to contaminate the wound A wound will become infected if the inoculum is sufficiently large and if the host provides a good medium, a situation that may be promoted by gross surgery If large amounts of necrotic material are left around each tie for example, then a good supply of pabulum is already present for the arriving bacteria

A wound infection may appear any time after surgery However in patients who have not received antimicrobials it usually occurs from the fourth to the seventh day Once a wound has become infected the proper treatment is drainage Increasing the chemotherapy or switching to another drug is valueless The over all wound infection rate of the Department of Surgery of Cornell Medical Center is 1 per cent Staphylococcal and enteric infections are equally represented Because of the nature of the operative procedures about 65 per cent of the infections in persons over 60 years are enteric

Pseudomembranous Enterocolitis (Staphylococcal Enterocolitis)

This disease is not always readily or correctly diagnosed Consequently many and varied opinions about etiology and treatment have developed There is reason to believe that the condition is usually associated with profound fluid loss from diarrhea with fever and with abdominal distention all of which occur after bowel surgery It may have one of several possible etiologic agents Staphylococci are most commonly implicated because many cases are not well documented or even recognized Typically this disease occurs in patients receiving antimicrobials following large bowel surgery If the clinical signs and symptoms cited above are used as criteria one comes to a different conclusion about incidence and etiology than if another set is used The situation is admittedly confused However certain facts are known The disease presents itself clinically with explosive suddenness Death may occur in a few days or hours The warning signs are protean but do appear Treatment must be intense and vigorous

In the author s experience enterocolitis most frequently occurs in the postoperative patient who has received antimicrobials It has usually been associated with staphylococci demonstrable by smear and culture of the stool or gastric contents There are cases however where the lesion is confined at least in the early stages to one segment of bowel and these may not show a pure culture of staphylococci by rectal smear Many doctors therefore treat the disease as if it were in its early stages rather than waiting to make a positive bacteriologic diagnosis before instituting therapy

The disease is best recognized and treated if one is constantly on the alert for it There are many possible causes for diarrhea distention, vomiting or fever However a smear and culture of the stool or vomitus may be most helpful if it reveals Gram positive cocci in great numbers If a suspicion of staphylococcal enterocolitis arises the patient should be treated as if the diagnosis were definitely established Fluid should be accurately replaced, all antimicrobials in use should be stopped whatever particular drug is known to be most effective against the indigenous hospital staphylococci should be administered corticotropin or corticosteroids in large amounts should be given if the patient develops shock At present the author prefers novobiocin 500 mg every 6 hours intravenously Erythromycin may also be selected as well as ristocetin kanamycin or oleandomycin

Two cases will illustrate this disease one in which the diagnosis was missed and a second, in which treatment was begun in time

Case Report No 1 (N Y H No 606852)

This 70 year old white male was admitted to The New York Hospital on April 5 1955 with a diagnosis of carcinoma of the tongue He had difficulty in swallowing and induration of the floor of the mouth It was

believed he had a carcinoma of the tongue with extension and infection There were palpable ipsilateral cervical nodes He was placed on clear fluids and penicillin 300 000 units and streptomycin 0 5 Gm twice a day Two days later a biopsy of the tongue under local anesthesia con firmed the diagnosis At this time the pa tient was up and about the ward without difficulty Two days after the biopsy he developed anorexia and vomited once The following day he had three loose stools and vomited twice His abdomen was dis tended and he was placed on parenteral fluids and nothing by mouth The follow ing morning his temperature rose to 39 C and he went into shock After medical con sultation he was transferred to the medical service with a diagnosis of myocardial in farction Twelve hours later he died By this time he was having tremendous quan tities of diarrheal stools which amounted to about 7 000 cc in the previous 12 hours Postmortem examination revealed a carci noma of the tongue with cervical node in volvement and extensive staphylococcal enterocolitis There was no recent heart lesion

COMMENT The disease was never really suspected except in the last few hours be fore death when it was too late The diag nosis could almost surely have been made 2 to 3 days earlier by smear and culture of the stool and vomitus Without doubt prompt therapy at this time would have resulted in a more favorable outcome

CASE REPORT No 2 (N Y H No 669475)

This 62 year old white male was admitted to The New York Hospital in February 1957 He had moderate pulmonary em physema and chronic cholecystitis After diagnostic evaluation an uncomplicated cholecystectomy was performed Postoper atively he received tetracycline because of the pulmonary disease On the fourth post operative day the patient developed fever tachycardia abdominal distention and profuse diarrhea This amounted to about 5 000 cc per day Smear of the stool showed many Gram positive cocci (later identified as hemolytic *Staphylococcus aureus*) He was treated within a few hours of the onset of his symptoms with massive fluid replacement erythromycin intravenously 2 Gm per day and when the susceptibility tests were reported with chloramphenicol On this regimen he grad ually improved Treatment was stopped after 1 week and symptoms began to re appear thus treatment was reinstituted for ? weeks After this it was stopped and the patient was discharged He had no further symptoms Stool cultures showed a normal flora

Eleven well documented cases of pseudo membranous enterocolitis have been seen in the past 5 years at Cornell Medical Center All but 1 of these has been over the age of 60 There have been many more cases where the diagnosis has never been fully established but where treatment was com menced promptly These patients also fall into the older age groups

ANTIMICROBIAL AGENTS

It is the policy of the Department of Surgery of The New York Hospital not to em ploy these various drugs prophylactically Our studies of septic complications of opera tion show no evidence that purely prophy lactic drugs are of any benefit

Some of the more useful drugs are men tioned below Because it is obviously impos sible to cover all of them or even to be up to date since new drugs appear with in creasing frequency it is perhaps better to keep in mind some basic properties of the drugs so that new ones may be critically evaluated The important characteristics of the antimicrobials are degree of bactericidal activity toxicity emergence of bacteria re sistant mutants It has become popular to list drugs in groups e g the Gram negative drugs or the bactericidal drugs Such cate gories are quite forced and arbitrary Not all drugs said to be bactericidal are so and vice versa In general there are three or four types of drugs that fall into separate cate gories Drugs within these categories func tion similarly at least on a clinical level These groups may loosely be considered as the penicillin streptomycin tetracycline and erythromycin novobiocin groups A separate group comprises the sulfonamides The spec tra of many of these overlap but to a certain

degree they are effective in independent fields

Penicillin Group

Penicillin

Apparently the versatility of this drug has only been partially explored Increasing dosages plus excretion blocking agents and the use of gamma globulin in conjunction with penicillin suggest a much wider field of employment

The most common available form is the benzyl type Oral and parenteral forms are available

Spectrum Penicillin is effective against most Gram positive organisms and some Gram negative cocci (*Neisseria gonorrhoeae*) It is not effective against the mycobacteria which are Gram positive In the case of other Gram positive rods penicillin varies somewhat in its effectiveness but in general it is very useful and reliable The streptococci are usually susceptible and the group A (beta hemolytic) streptococci are uniformly so Some enterococci are resistant as are many of the anaerobic streptococci Staphylococci especially the hemolytic coagulase positive aureus type may be penicillin susceptible or resistant Almost all staphylococcal infections arising in the hospital are penicillin resistant Of those which begin outside the hospital over half are penicillin susceptible Penicillin resistance is partially due to a penicillin destroying enzyme (penicillinase) which some strains of staphylococci produce Of the penicillin resistant strains isolated in the Department of Surgery of The New York Hospital over a 1 year period (1958) and examined in the Surgical Bacteriology Laboratory *every one has produced penicillinase* In combination with streptomycin penicillin is effective in mixed (enteric) infections

Advantages Penicillin has no practical toxicity It is very potent against susceptible strains Experimentally it is bactericidal in adequate dosage against most organisms in its spectrum Synergism with streptomycin can be demonstrated against penicillin susceptible strains in experimental in vivo situations (McCune, Dineen and Batten) In combination with streptomycin penicillin is effective against mixed flora infections

Complications These are mainly due to hypersensitivity reactions which may be immediate or delayed They are manifested either by urticaria and edema of the mucous membrane or skin or by arthralgia fever, etc typical of serum sickness

Dosage Much of the dosage of penicillin has been based on attaining therapeutic serum levels This is not a very reliable index as Tompsett has shown Furthermore there is no direct proof that a high serum level reflects tissue level or therapeutic effectiveness Nevertheless, there is ample clinical evidence to prove that some diseases particularly various forms of bacterial endocarditis may require larger doses and more prolonged therapy than was originally believed This has led to another reevaluation of penicillin dosage Originally the standard dose of penicillin was 160 000 units of penicillin each day in divided doses at 3 hour intervals The next step was to 600 000 units a day in two doses Now in severe infections it is not uncommon to use 25 million units a day

Aqueous Crystalline Benzyl Penicillin G

Dose 100 000 to 2,000 000 units

Route of Administration It is usually given intramuscularly it can be given as an intravenous drip

Comment This form of penicillin is the most rapidly effective and high serum concentrations are reached in 15 to 30 minutes They are sustained for 90 to 180 minutes To maintain this high level in serum dose must be repeated at least every 2 to 3 hours

Procaine Penicillin G in Aqueous Solution

Dose 300 000 to 600,000 units

Route of Administration It is administered intramuscularly

Comment This form does not attain as rapid or as high a plasma concentration as the crystalline form However the therapeutic levels are sustained for over 12 hours usually for 24 One dose every 12 hours is sufficient and more frequent doses will not significantly raise the serum level

Oral Penicillin G

Dose 200 000 to 1 000 000 units

Route of Administration It is administered orally

Comment A peak plasma concentration is attained within 1 hour and the drug is almost gone in 3 hours However for acute infections requiring relatively large amounts of penicillin one million units by mouth every 3 hours is effective This dosage form is not good for prolonged prophylaxis

Penicillin V

Dose 200 000 to 500 000 units

Route of Administration It is administered orally every 6 hours

Comment This form is useful for prolonged elevation of the serum concentration However therapeutic peaks i e levels required for the treatment of acute infections are not obtained consistently Individual high peaks usually occur with the relatively high serum concentration

Bacitracin

Spectrum It is effective against most Gram positive organisms and also against *Neisseria* and *Haemophilus influenzae* It has two main uses at present (1) against resistant staphylococcal infections and (2) against progressive bacterial synergistic gangrene

Advantages Bacterial (staphylococcal) resistance emerges slowly in vivo compared to other drugs except penicillin

Complications Bacitracin is basically nephrotoxic With its use there is some nitrogen retention and albuminuria This has never been permanent and in the author s experience has always disappeared after removal of the drug In the presence of renal damage however the drug should not be used or should be used only with extreme caution This drug is for hospital use

Dosage It is administered intramuscularly 50 000 to 150 000 units daily in three to four divided doses

Ristocetin

This drug commercially is a mixture of two ristocetins (A and B)

Spectrum It is effective against staphylococci enterococci streptococci and pneumococci It is recommended for severe resistant staphylococcal infections and for acute and subacute bacterial endocarditis

Advantages The drug has much greater in vivo effectiveness than sensitivity studies indicate It has shown good results in patients with overwhelming staphylococcal infections which were resistant to all other drugs

Complications Caution must be observed that bone marrow depression does not occur This is manifest as a neutropenia Therefore frequent white blood cell counts should be performed while the patient is receiving therapy Rarely minor cases of skin rash occur The drug is very irritating to extravascular tissues and should be administered only intravenously

Dosage Ristocetin is given only by vein usually by the drip technique in 5 per cent dextrose in water over a period of 30 to 40 minutes The dosage ranges from 25 to 75 mg per kg per day In a 75 kg patient this amounts to 2 to 6 Gm per day The latter is the maximum dose and is used only in severe resistant strains in bacterial endocarditis

The total dosage should be divided into two to three equal parts during a 24 hour period

Streptomycin Group

This group comprises those drugs related by their primary effectiveness against Gram negative organisms

Streptomycin and Dihydrostreptomycin

Bacteriologic bioassay has revealed no difference in these two drugs and probably they function at the cellular level as one

Spectrum These drugs have a broad spectrum Although they are described as primarily effective against Gram negative organisms, actually both of these agents are effective against staphylococci streptococci and the tubercle bacillus Resistance does develop in vivo In combination with penicillin streptomycin has an extremely wide spectrum

Complications Streptomycin is neurotoxic to the vestibular division of the eighth nerve and dihydrostreptomycin to the auditory division These unfavorable reactions are the result of total dose and may be greatly reduced by alternating the two drugs Any patient on prolonged therapy should have frequent audiograms and tests of vestibular function Bacterial resistance (except in tuberculosis) usually occurs within 2 weeks

Dosage The average daily dosage is 1 Gm intramuscularly in two divided doses On occasion this may be raised to 2 Gm per day for a short period (3 to 4 days)

Neomycin

Spectrum Basically it is the same as streptomycin However in 1 per cent solution for topical use it is bactericidal to all organisms It is commonly used for the cold sterilization of instruments

Advantages The drug should not be used systemically It is not absorbed from the gastrointestinal tract except in the most minute amounts It is therefore well suited for chemical preparation of the bowel for surgery

Complications This drug is toxic to the central nervous system both to the eighth nerve and to the brain stem Respiratory paralysis may occur with parenteral doses exceeding 2 Gm It is also nephrotoxic Because of these complications this drug is used only topically and orally at the Cornell Medical Center

Chemical Sterilization of the Gastrointestinal Tract (1) mechanical cleansing is most important (2) it is almost impossible to sterilize the bowel in the presence of obstructing lesion (3) the period of use of neomycin should not exceed 48 hours or resistant organisms appear (4) routine preparation of the bowel is as follows (*a*) clear fluid or low residue diet (*b*) alternating enemas and saline (*c*) supplementary vitamins including K (*d*) neomycin 1 Gm every hour for first 4 hours and then 1 Gm every 4 hours thereafter

Operation should be performed in the period between 36 and 48 hours after initiation of drug In case operation is to be done sooner (within 24 hours) the initial dose of neomycin in the first 4 hours may be doubled

In the author s experience the addition of other agents to neomycin has not contributed any further protection or prevented more bacterial complications

Intraperitoneal Neomycin In cases of peritonitis or gross contamination at the time of operation neomycin is of benefit in reducing postoperative complications both intraperitoneally and in the wound

Neomycin sulfate (sterile powder) 1 Gm is added to 100 cc of distilled water or saline (1 per cent solution) This is placed in the peritoneal cavity and in the layers of the wound in closing A period of 10 minutes contact should allow the neomycin to kill most bacteria present Note that no more than 1 Gm should be used

This same solution may be used for topical applications if indicated

Polymyxin

This drug is a polypeptide of bacterial origin

Spectrum This agent is a potent bactericidal one against Gram negative organisms Because of its toxicity, other drugs are preferred However in the case of streptomycin resistant *Ps aeruginosa* infections polymyxin is the drug of choice

Complications This drug is nephrotoxic and neurotoxic When it is used careful observations must be made for nitrogen retention or albuminuria If this occurs the drug dosage must be reduced or completely stopped In patients with impaired renal function the drug should not be used unless absolutely necessary and then at lower dose levels The drug is excreted by the kidneys so that in poor renal function high serum levels are built up

Dosage Route of administration is intramuscular The daily dosage should not exceed 2 5 mg per kg This should be administered in three equally divided injections No more than a total 200 mg should be given to any one patient in a 24 hour period

Kanamycin

Spectrum The drug has a spectrum similar to that of streptomycin It is active against Gram negative organisms and also against staphylococci and *Mycobacterium tuberculosis* Its use is restricted however mainly to resistant staphylococcal infections and certain Gram negative infections that do not respond to routine therapy

Complications It has not yet been thoroughly tested clinically There is evidence of renal toxicity (casts albuminuria and hematuria) on occasions and of eighth nerve toxicity after prolonged administration Skin eruptions and neutropenia also occur

Dosage The daily dosage (adult) is 1 to 2 Gm in four divided doses administered intramuscularly The drug is not well absorbed from the gastrointestinal tract

Tetracycline Group

Tetracycline

This is the prototype of this group Although it was the last on the clinical scene it has practically replaced chlortetracycline and oxytetracycline

Spectrum The tetracycline drugs are commonly referred to as having a broad spectrum Actually the spectrum is not as broad in many ways as that of streptomycin or neomycin However, tetracycline in vivo is apparently bacteriostatic in most instances, and experimental studies conducted at Cornell Medical Center indicate that the tetracyclines are most effective against an actively multiplying bacterial population Tetracycline is active against Gram positive cocci and rods and Gram negative cocci and rods Progressively more strains of staphylococci are found to be resistant

Advantages Convenience of oral dosage in many instances is a deciding factor in selecting drug Good blood levels are rapidly obtained

Complications Nausea vomiting and diarrhea are seen with cases due to direct chemical irritation

Secondary changes in bacterial flora lead to other distressing complaints associated with superinfection by either staphylococci Gram negative rods or fungi There may be thrush vaginitis or pruritus In severe cases pseudomembranous enterocolitis may occur

Dosage It is given orally 1 to 2 Gm per day in four divided doses, intravenously 1 to 2 Gm per day in two divided doses intramuscularly (very painful) 0 5 to 1 5 Gm per day in two divided doses

Chlortetracycline and oxytetracycline follow the outline given above for tetracycline In general they are somewhat more toxic to the gastrointestinal tract

Chloramphenicol

Spectrum It has the same spectrum as tetracycline plus *Salmonella typhosa* Chloramphenicol is a much more effective antistaphylococcal agent than tetracycline It has a lower incidence of emergence of resistance and the majority of penicillin resistant hospital strains studied in Cornell Medical Center are susceptible to chloramphenicol

Complications Besides those associated with the superinfection of broad spectrum drugs chloramphenicol in infrequent instances does depress the hematopoietic system Consequently when the drug is used blood counts should be done at regular intervals

Dosage It is administered orally 1 to 4 Gm per day in four divided doses and intramuscularly 1 to 2 Gm daily in two divided doses

Erythromycin Novobiocin Group

This group is composed of antistaphylococcal agents The bulk of research in this field is directed toward enlarging this particular group

Erythromycin

Spectrum Although this drug has a spectrum similar to that of penicillin and bacitracin i e active against most Gram positive organisms and Gram negative cocci its use has been restricted to penicillin resistant staphylococci When first made available commercially erythromycin encountered remarkably few resistant organisms In the past 5 years at Cornell Medical Center the number of staphylococcal erythromycin resistant infections has increased but still is well below 20 per cent

Advantages It is a relatively nontoxic drug which can be given for long periods of time by mouth

Complications Very rarely some gastrointestinal symptoms (anorexia nausea) may occur

Dosage Oral dosage is 1 to 3 Gm per day in four to six equally divided doses Intravenous dosage is 1 to 2 Gm per day in two equally divided doses Intramuscular dosage is 400 to 600 mg daily in four to six divided doses (100 mg per single dose)

Novobiocin

Spectrum Studies performed at Cornell Medical Center indicate that novobiocin is primarily active against staphylococci and some strains of *Proteus* There is an irregular effectiveness against streptococci and Gram positive rods However novobiocin at present enjoys widespread popularity because of its ability to combat antibiotic resistant strains of staphylococci In instances of hospital infections e g staphylococcal enterocolitis novobiocin is one of the drugs that should be considered for use in treatment This drug is not as effective an antistaphylococcal agent as penicillin or streptomycin but because of the emergence of more and more strains resistant to these drugs novobiocin is more effective in actual practice

Complications Novobiocin may cause bone marrow depression which may be manifest as a chronic toxicity or as a relatively acute hypersensitive reaction All elements may be depressed but usually a neutropenia or thrombocytopenia occurs Frequent blood counts should be done

Skin rash diarrhea, and gastritis also occur rarely

Occasionally a pigmentation will appear which suggests that the patient is jaundiced Examination of the serum bilirubin reveals the pigment entirely in the indirect fraction Chemically this is not really bilirubin but a breakdown product of novobiocin which may give a confusing colorimetric result in the laboratory test

Novobiocin can be given in the presence of jaundice or liver disease

Dosage It is administered orally 1 to 2 Gm daily in four equally divided doses and intravenously 1 Gm per day in two divided doses

Miscellaneous Group

Sulfonamides

The use of sulfonamides in surgical patients now has decreased markedly This is not because of loss of effectiveness (as has been true of more modern agents) but because drugs less toxic more easily administered and with greater antibacterial powers have appeared on the scene

The use of sulfonamides is confined largely to the treatment or prevention of urinary tract infections A dosage of 1 to 4 Gm per day may be used Actually dosage depends on the commercial preparation selected because some require only one tablet a day to maintain adequate urinary levels

In the case of more severe urinary tract

infections some of the other agents are preferable

Nitrofurans

The use of the nitrofurans is quite wide spread They can be used orally topically or intravenously

They have a wide bacterial spectrum of activity including staphylococci strepto cocci and Gram negative organisms This drug may be bactericidal in easily attained in vivo levels

The nitrofurans are primarily used in the form of nitrofurantoin an agent for the treat ment of urinary tract infections It has a low toxicity and only infrequently are nausea and vomiting encountered Occasionally a diffuse maculopapular rash may occur

Dosage The dosage is 300 to 600 mg daily in four equally divided doses

Duration of Treatment with Antimicrobial Agents

It may be noted that in the discussion of the various antimicrobial agents duration of treatment has not been mentioned This point has been omitted because each case represents such an individual problem that to suggest any time limit is misleading

In general when an antimicrobial drug is used and is apparently effective it should be continued (perhaps with gradual dose re duction) until a stabilized state is achieved In a beta hemolytic streptococcal infection this would mean perhaps 10 days of treat ment In recurrent staphylococcal furuncu losis treatment might require 3 months

The real danger in the use of antimicro bials (after one has decided to employ them) is failure to give large enough doses for long enough periods of time There is a tendency to use too little and to stop too soon

COMBINED DRUG THERAPY

Much has been written in the scientific and pharmaceutical literature about com bined drug therapy There is no doubt that certain drug combinations may be extremely effective and that true synergism may some times occur At Cornell Medical Center combined therapy (especially penicillin and streptomycin) is employed frequently How ever it is the policy not to use two drugs where one will suffice Therefore it seems more specific treatment to decide from the bacteriology of the case what drug or drugs are indicated and then to prescribe them in the individual amounts desired

SUMMARY

An outline of the diagnosis and treatment of surgical infections in the aged as prac ticed at Cornell Medical Center is presented

Each individual antimicrobial drug used in the Department of Surgery has been listed along with its spectrum complications and dosage

BIBLIOGRAPHY

Charcot J M and Loomis A L *Diseases of Old Age* William Wood & Company New York 1881 Lecture 2 p 27

Dineen P and Pearce C A Ten Year Study of Wound Infections Surg Gynec & Obst 106 453 1958

Foster F P and Copeland A B Use of An tibiotics in Surgery of the Aged S Clin North America June 609 1954

Homburger F The Medical Care of the De bilitated Hospitalized Aged Geriatrics 11 *163 1956*

Leibola Elli and Vartia K O On Penicillin Levels in Young and Geriatric Subjects J Gerontol 12 48 1957

McCune R Dineen P and Batten J C The Effect of Antimicrobial Drugs on an Experimental Staphylococcal Infection in Mice *Ann New York Acad Sci 65* 91 1956

McLaughlin C W Jr and Heider C F Infection and Gangrene in the Extremities of Aging Diabetics Geriatrics 10 571 1955

Medalia L S and White P D Diseases of the Aged J A M A 149 1433 1952

Mueller Deham Albert Are Geriatric Mortal ity and Morbidity Statistics Reliable? Geri atrics 1 285 1946

Pratt Robertson Antibiotics in the Elderly Patient Geriatrics 11 341 1957

Rammelkamp C H Factors Determining the Dosage of Penicillin in the Treatment of Infection Bull New York Acad Med 21 656 1945

Rantz L A Consequence of the Widespread Use of Antibiotics California Med 81 1 1954

Simon H J McCune R M Dineen P and Rogers D Studies on Novobiocin a New Antimicrobial Agent Antibiotic Med 2 205 1956

Tompsett R Shultz S and McDermott W Influence of Protein binding on the Interpretation of Penicillin Activity in Vivo Proc Soc Exper Biol & Med 65 163 1947

3

Preoperative Evaluation and Preparation for Surgery

Frank Glenn and John M Beal

PREOPERATIVE EVALUATION

The period prior to operation is particularly critical for the elderly patient The frequent association of diseases other than the primary process complicates the management of the immediate problem Thus a search must be made for possible physiologic derangements which might influence the response of the patient to surgery There are two important goals in the evaluation of older persons The first is the detection of aberrations of normal physiology particularly those of chronic or degenerative origin so that these may be corrected whenever possible before operation is undertaken The second is the evaluation of the effect of concomitant diseases upon the course of the patient after surgical treatment of the primary process It is apparent that some derangements can be corrected satisfactorily others in part and some not at all Because some geriatric patients present evidence of malfunction of several organ systems the physician must be cognizant of the multiplicity of the problems and must attempt to assess the relative importance of each By means of careful detailed study of each patient in the older age group they may often be carried through precarious illnesses

The evaluation of the aged patient must begin with a careful history The perceptive physician will note that many elderly patients tend to minimize or belittle certain symptoms that may be of importance during the stress of major surgical trauma For example angina or dyspnea on exertion may be admitted by some stoical older patients only after specific questions aimed at eliciting this information There are other elderly patients who may have impairment of memory particularly for recent events or for time relationships Such difficulties in history taking are magnified in acute illnesses or after traumatic injuries Much can be gained by the presence of a close relative during the interview A satisfactory history may often require two periods of interrogation one with the patient and one with the family or a responsible member of the family

Needless to say the review of systems and the past history constitute an important part of the anamnesis and must be as thoroughly investigated as the present illness While it is not feasible to cover all aspects of history taking in this section certain points merit emphasis Whether the problem which the patient presents requires emergency or elective operation the onset and duration of symptoms carry major significance This facet is discussed in several of the succeeding chapters that deal with specific diseases One area of inquiry is often especially rewarding in this respect Determination of weight loss may assist greatly in preoperative evaluation Sudden drop in body weight

over a few days indicates loss of body water and is suspicious of fluid and electrolyte im balance Diminution of body weight over a period of weeks or months may be accepted as evidence of depletion of body stores of protein and fat All too often attention is not given to the consequences of such losses Further loss during the catabolic period may be *an important factor in the development of* postoperative complications

Functional capacity is a valuable aid in the assessment of elderly surgical patients Direct information can often be obtained from a discussion of the patient s daily activities such as shopping carrying bundles, climbing subway steps and the frequency with which he climbs stairs if he lives above *the first floor Indirect information* can be secured from answers to inquiries about sleeping habits hobbies appetite etc

Examination of the patient must be com plete and thorough The physical findings may reveal additional problems that the pa tient has either failed to mention or has not noticed For example careful inspection of the skin in elderly patients may disclose cu *taneous neoplasms such as basal cell carci* noma of the skin of the face The alae nasi require close scrutiny because small lesions of this type are common and easily over-looked in this location Loss of visual acuity and auditory impairment should be noted be cause both may influence later management Visualization *of the eyegrounds as well as* palpation of the peripheral vessels gives im portant information concerning the degree of arteriosclerosis Attention must be directed to the oral cavity Vitamin deficiency may be discovered by the presence of cheilosis Oral hygiene and repair are often poor in older patients *This may have bearing upon* the type of food that the patient may accept since edentulous or partially edentulous pa tients can chew only soft foods Poor dental hygiene is a contributing factor to the de velopment of parotitis in the postoperative period

The remainder of the physical examina tion should be conducted with similar atten *tion to details in the* search for unsuspected diseases A careful rectal examination is needed in older men because *the incidence* of carcinoma increases significantly after 60 years of age Early lesions can be detected by rectal examination before symptoms occur

The laboratory tests to be employed rou tinely before operation include a complete *blood count and urinalysis,* a *roentgenogram* of the chest and an electrocardiogram Guaiac tests of stool specimens for occult blood are obtained from patients with ane mia or with gastrointestinal complaints Gastrointestinal bleeding in old age may oc cur with few, if any subjective symptoms *that direct attention to the alimentary canal* Some of these patients complain of angina due to resultant *myocardial ischemia* The demonstration of anemia by the blood count and the detection of occult blood in the stools are often the clues to the patient s source of difficulty

Study of the gastrointestinal tract should not be considered complete without procto *scopic examination There are* now a number of commercially available packaged enemas that simplify the preparation of the rectum *for this procedure Such enemas are usually* quite effective and do not tire the patient as much as repeated soapsuds or tap water enemas

Gentle understanding in handling the older patient is often quite rewarding Many of these patients have a feeling of inadequacy to the new environment and this may de velop into fear that they will not survive an operation Repeated explanation *and reassur* ance is often required Reduced oral intake *is another problem* that must be considered in the investigation of the elderly patient This is particularly pertinent in the multiple roentgenographic studies that are often re quired for the patient with symptoms or findings that *relate to the* gastrointestinal tract Many of these patients have a rather limited oral intake and if the gastrointestinal

roentgenograms are not judiciously spaced further significant limitation of oral intake and accelerated losses from purging ensue This may further deplete a malnourished patient

Blood volume determination is a useful laboratory adjunct when this is available to the clinician Deficits in the intravascular compartment need correction prior to operation in order to avoid the consequences of shock A decreased volume of red cells is an indication for transfusion of packed red cells This is a frequent finding in patients who have suffered from recent bleeding The plasma fraction of the blood is more rapidly synthesized by the body than are the erythrocytes In such instances incautious transfusion of whole blood carries the danger of overloading the circulation by expansion of the total blood volume In the presence of diminished myocardial reserve cardiac decompensation may occur

The body weight of the patient should be determined on admission and at regular intervals before operation Change in body weight is a useful index to fluid balance The patient s weight should be obtained in the morning after voiding in a fasting state and preferably nude The preoperative weight can assist greatly in the management of fluid balance problems that may occur in the post operative period

Blood chemistries are chiefly of value according to the specific problems with which the physician is faced Before major procedures determination of the blood urea nitrogen or nonprotein nitrogen level is an aid in the detection of diminished renal function An elevated blood urea nitrogen level in the absence of causes of prerenal azotemia is strong evidence for serious renal impairment and is an indication for additional study of renal function e g urea clearance The presence of seriously diminished renal function carries a grave threat to those patients who must be subjected to operation

Cardiac and pulmonary diseases are common in older patients Pulmonary complications frequently occur in the period after operation in the geriatric group Unfortunately it is often difficult to test accurately the reserve or functional capacity of these systems before operation Valuable information is obtained from the chest roentgenogram and from the electrocardiogram The radiologic study of the chest will indicate cardiac size and configuration and may reveal specific enlargement of the heart chambers Evidence of calcification or aneurysmal dilatation may be found in the great vessels Cardiac function can be investigated further by determination of venous pressure and circulation time The electrocardiogram not only provides information about the cardiac rate and rhythm but may suggest evidence of myocardial irritability Gross evidence of abnormal function such as cardiac failure is associated with a poor prognosis if operation must be undertaken Recent myocardial infarction also represents a serious hazard to the patient However the history of an old myocardial infarct the presence of electrocardiographic evidence of coronary artery disease or bundle branch block does not necessarily carry an ominous prognosis Patients with these latter lesions usually tolerate operation well unless shock or anoxia occur

The examiner must make special note of history of dyspnea orthopnea wheezing or cough and of the finding of emphysematous expansion of the chest rales or rhonchi A history of recent limitation of activity indicates scrutiny of the pulmonary and cardiovascular system Preoperative evaluation through attempts to test pulmonary function by vital capacity determinations has been disappointing Exercise tolerance is perhaps the most satisfactory index from the practical point of view This can be done as the examiner walks with the patient along the hospital corridor or up a flight of stairs Tolerance to this type of exertion with records of pulse and respiratory rates before and after the test will aid in the evaluation of the patient s reserve Though this test is simple and not

specific, the examiner can readily detect impairment of cardiopulmonary reserve

PREPARATION FOR SURGERY

The depth and scope of problems must be considered in the elderly patient Familiarity with these is helpful in attempts to detect problems that have a direct relation to the preparation of the patient for operation This may be illustrated by consideration of the frequency of prostatism in men over the age of 60 Prostatic obstruction is a major contributing cause to direct hernia in this age group Hesitancy and straining at urination suggest some degree of urinary retention or obstruction to the bladder Residual urine should be determined in such patients Failure to consider prostatic obstruction can lead to the complication of urinary retention and its consequences in the period following operation Varicose veins of the saphenous system are also common in older patients The presence of varicosities of the lower extremities should be noted so that elastic support can be applied when operation is performed The application of such support aids the venous circulation and appears to afford some protection against phlebothrombosis and pulmonary embolism

Surgical emergencies present a serious threat to survival in many elderly patients and require prompt and judicious attention The preceding remarks were designed to provide a background for the preparation of the patient primarily for elective surgical procedures While the principles of careful detailed evaluation already mentioned should provide the basis for all management certain modifications in approach must be employed when the physician is confronted with emergency surgical conditions The most commonly encountered problems of this type are traumatic injuries, intestinal obstruction vascular occlusion and perforations of abdominal viscera Early recognition is essential so that prompt operative intervention can be undertaken before physiologic derangements occur Restoration of blood volume by the administration of appropriate fluid therapy is indicated before operation is undertaken However, when surgical treatment is necessary, it should be performed as soon as possible The opportunity of salvaging the older patient may be lost if preparation for operation is prolonged in the hope of achieving optimum conditions The operative procedure should be limited to that which is necessary to control the condition that threatens the patient s life For example the patient with obstruction of the distal colon should be treated by transverse colostomy Exploration of the abdomen will prolong the operation and increase the morbidity A definitive attack upon the lesion that precipitated the obstruction can be made when suitable study and preparation have been carried out at a later date

The complications that threaten the older patient after emergency operations are chiefly pneumonia shock, renal insufficiency and myocardial infarction Precision in diagnosis, prompt intervention and careful postoperative care can accomplish much in improving the results of treatment in this group

4

Anesthesia

Joseph F Artusio, Jr

GENERAL CONSIDERATIONS

Physical Status and Anesthetic Risk

Before he is subjected to anesthesia and surgery the aged patient must have a careful history taken and physical examination made in order for his physical status to be evaluated A complete history and physical examination are extremely important for all patients but especially for those older than 60 years whose organ systems may be impaired by the degenerative changes of age or by disease With the information provided by the history and the physical examination the anesthesiologist can plan the anesthetic management in consideration of the patient s physiologic rather than his chronologic age These ages may differ widely from patient to patient Thus the elderly patient may have organ systems which respond well to a stressful situation while a younger individual may show much poorer responses to stress

However a patient s physical status does not necessarily bear a close correlation to the risk involved in giving him an anesthetic Physical status refers to the physiologic condition of the patient independent of any anticipated surgery In assessing the anesthetic risk one must not only consider the physical status but also the skill of the surgeon the ability of the anesthesiologist the type and duration of surgery and the position of the patient during the operation as well as the individual s physiologic response to trauma

The American Society of Anesthesiologists has adopted a rather precise and dependable classification of physical status Every patient who is to undergo anesthesia at The New York Hospital is placed in one of the seven grades listed below and the anesthetic regimen is conducted according to his physiologic tolerance

1 An individual with no organic disease or with localized disease which causes no systemic disturbance

This includes patients suffering from fractures unless there is shock congenital deformities and orthopedic deformities without systemic disturbance localized infections without systemic manifestations uncomplicated hernias

2 An individual with moderate systemic disturbance

Mild diabetes mild acidosis moderate anemia pharyngitis chronic sinusitis early incarcerated hernia cardiac functional capacity I or *IIa*

3 An individual with severe systemic disturbance

Poorly controlled diabetes intestinal obstruction advanced sufficiently to cause a physiological disturbance reduced vital capacity as from tuberculosis severe trauma cardiac functional capacity *IIb*

4 An individual suffering from systemic disorders which are an imminent threat to life

Severe trauma with irreparable damage severe long standing intestinal obstruction cardiovascular disease with inadequate functional capacity III decompensation severe renal disease

5 All patients who are operated upon for emergency conditions who would otherwise be in classes 1 or 2

6 All patients who are operated upon for emergency conditions who would otherwise be in classes 3 or 4

7 All patients who are moribund

Frequently the aged patient's organ systems are compensating in a borderline fashion so that any error in the anesthetic management may make the difference between success and disaster. Therefore it is important that each consultant complete his evaluation of the patient in regard to his particular specialty before the anesthesiologist plans the anesthetic management.

The Preanesthesia Visit

In addition to the information provided by the history and physical examination, all the laboratory data should be available to the anesthesiologist when he visits the patient. Such information should include at least a blood count and a complete urine analysis, but in the geriatric patient the electrocardiogram and the chest plate should almost be a routine. The chest plate is most worthwhile particularly to demonstrate emphysema, pulmonary fibrosis, cardiac enlargement, and bony abnormalities of the thoracic cage. The electrocardiogram may point out unsuspected arrhythmias and, most important, coronary occlusions which have been unsuspected and have occurred without chest pain or any recognizable symptoms. These data may, of course, considerably alter the anesthetic management, and the anesthesiologist forewarned with this information is indeed forearmed.

The anesthesiologist's visit the night before surgery is a most important one, particularly to the geriatric patient. These older persons fear what will happen to them in the operating room and usually have no conception of how they will be put to sleep. They are also afraid that they will not awaken. For some patients this is the first experience with hospitals, surgery, and anesthesia. Others may remember with fear or even terror an early anesthetic experience when administration of open drop ether was accompanied by a struggle for air. Not infrequently a patient will want an anesthetic he had for previous surgery which was perfectly suitable at that time but which would prove hazardous in view of his current physical status.

The anesthesiologist should explain to the patient what *is going* to happen to him the evening *before operation* and what will take place *immediately* before he is brought into *the operating* room. He can also inquire about any *drug sensitivities* and about any episode *during a previous* anesthetic that may have come to the patient's *attention.*

Reassurance of the geriatric patient will do much to make his operative course smoother, because he will know what to expect and thus will lose a good part of his fear of the unknown.

The patient should also be assured that measures will be taken to minimize postoperative pain and that he will be taken to a recovery unit where other patients will also be present. He should be cautioned not to be alarmed if he awakens with an oxygen mask on his face or in an oxygen tent, that these measures are a part of routine postoperative care.

Because of his particular interest in circulatory and pulmonary physiology, the anesthesiologist may wish to do his own physical examination, especially of those systems which are reported to be abnormal.

Drugs Used by the Patient Prior to Anesthesia

Cortisone and Adrenal Cortical Preparations

Very frequently the geriatric patient has received cortisone or adrenal cortical preparations before he is considered for surgery, or he has been on cortisone therapy and develops gastrointestinal bleeding necessitating surgical intervention. It is most important *that with patients* who have been on cortisone therapy within the year, special precautions be taken to prevent a mortality related to the increased stress of surgery and anesthesia.

The adrenocorticoid administration decreases the ability of the adrenal cortex to function and may induce a state of atrophy. It is noteworthy that administration of adrenocorticotropic hormone (ACTH) may produce a similar physiologic state. This

state of potential hypoadrenalism cannot be diagnosed It does not become unmasked until the added stress of anesthesia and surgery is inflicted on the organism Before we were acutely aware of the problem it was not uncommon during anesthesia and surgery to observe falls in blood pressure which were resistant to whole blood administration and which showed only poor and transient improvement with vasopressor drugs Deaths in the early postoperative period from hypoadrenalism due to this cause have been reported In essence patients who suffer this fate are Addisonian in behavior and die in uncontrollable hypotension

Because treatment with these drugs is so common today a special point should be made when one takes the history of all patients to learn whether they have received corticoids within the past year If they have taken these compounds irrespective of the dosage they should be prepared with approximately 300 mg of cortisone the day before the operation the day of the operation and for the first 3 postoperative days and then the dose should be gradually decreased to the maintenance level This regimen will tend to prevent the occurrence during anesthesia of hypotensive episodes related to hypoadrenalism It is still most important that intravenous hydrocortisone be available in the operating room in the event that the preoperative preparation with cortisone is insufficient

Because of the low incidence of hypoadrenalism due to this cause some feel that it is superfluous to pretreat with high doses of cortisone and that it is only necessary to recognize the hypotensive state during the operation and to treat it at that time with intravenous hydrocortisone This is risky therapy for one cannot predict which patients will develop hypotension from this cause during a surgical procedure Furthermore the author believes that it is better to prevent an emergency than to be forced to treat one by drug therapy during anesthesia Therefore it is believed that a regimen of pretreatment before operation and provision of hydrocortisone for possible emergency intravenous use during anesthesia assures maximal safety

Chlorpromazine and the Rauwolfia Compounds

These tranquilizers and antihypertensive drugs for the treatment of hypertension are frequently used in the geriatric patient and careful investigation concerning the use of these compounds is most important These drugs interfere with the cardiovascular compensatory mechanisms When they are used in conjunction with general anesthesia tachycardia or hypotension may develop following induction of anesthesia or during the operative procedure and may be extremely refractory to vasopressor medication Therefore chlorpromazine should be omitted at least 8 and preferably 24 hours before the induction of anesthesia and the rauwolfia compounds should be omitted at least 10 days to 2 weeks before elective surgery

If circulatory collapse due to this cause develops neosynephrine drip may be used in an attempt to produce peripheral vasoconstriction However it must be understood that the mechanism of this rauwolfia effect is still unknown and the neosynephrine may be of no avail If the patient is known to have been treated with a rauwolfia compound and emergency surgery must be performed the lightest possible level of anesthesia compatible with the surgical intervention should be maintained and perhaps cardiovascular competence may be retained Recent evidence indicates that anticholinergic drugs such as atropine and Antrenyl will reverse hypotension from this cause This evidence is still fragmentary but the therapy should be tried as these drugs can cause little harm

The Preanesthetic Medication

The preanesthetic medication must be considered an integral part of the entire anesthetic management Its purpose is to provide a restful night and to have the patient arrive in the induction room relaxed

and free from fear but not stuporous or comatose

The evening before surgery a fairly long-acting barbiturate, such as phenobarbital in doses of 60 to 100 mg, will usually give older patients a good night's sleep However, if they are used to taking barbiturates at home it is wise to let them use their accustomed medication in their usual dosage

As a group the aged become profoundly depressed on doses of central depressants which are well tolerated by younger persons However until recently it was quite customary throughout the world for the patient to receive an opiate and a belladonna drug, 1 to 1½ hours before the beginning of anesthesia and in many institutions the same drugs and dosages were almost routine for all patients The aged patient arrived in the anesthetic induction room in the profound depression as to awareness of environment associated with decreased ventilation and circulation Not only did this heavy premedication produce depression of the circulatory and respiratory homeostasis of the patient but in his stuporous state he could easily roll out of bed and injure himself When the premedication was given in doses that produced stupor the relaxation of the jaw and pharyngeal soft parts made him most susceptible to respiratory obstruction and asphyxia The opiates were given to produce a state of euphoria However doses that produced euphoria usually compromised respiration and circulation Beecher recently has pointed out that in a large percentage of patients opiates produce dysphoria rather than euphoria It was believed in the past that in addition to producing euphoria these drugs were direct metabolic depressants and would depress oxygen consumption and make anesthesia safer It was also believed that if oxygen consumption were diminished the patient would also have a lessened reflex irritability and would be protected from sudden death In addition the reduction of reflex irritability and oxygen consumption was presumed to make the induction of anesthesia easier and more rapid However, present knowledge indicates that in doses used for premedication these drugs have little effect on metabolism but instead only impair the ability of the respiratory and cardiovascular systems to compensate for the surgery and anesthesia

It is the author's belief that on the morning of surgery the drug of choice for psychic sedation is a barbiturate rather than an opiate The barbiturates are the true sedatives and hypnotics and are ideally suited for this purpose A dose of 50 to 100 mg of pentobarbital usually accomplishes this state satisfactorily in the patient over 60 years of age without risk of depressing respiration and circulation

The barbiturate should be combined with a belladonna drug to dry oropharyngeal secretions and in the aged atropine sulfate is the drying agent of choice Scopolamine hydrobromide, which has some advantage over atropine sulfate in children and young adults frequently causes delirium in the geriatric patient In addition to its drying action on oropharyngeal secretions atropine will produce some degree of vagal blocking action depending on the dose given The vagus tends to depress the irritability of the sinus pacemaker of the heart and may allow more irritable foci to become the originators of the electrical activity These more irritable foci will always be lower down in the conducting pathway and the rhythm may become atrioventricular nodal or even ventricular in origin By this mechanism atropine will help maintain the dominance of the sinoatrial node and thus contribute to the prophylaxis of cardiac arrhythmias during anesthesia

The only situation in which an opiate drug is preferable to a barbiturate for preanesthetic medication is in those patients who have severe pain before anesthesia begins Barbiturates in the presence of severe pain may produce delirium and it appears wise to use 25 to 50 mg of Demerol or 5 to 7 mg of morphine sulfate as part of the pre

anesthetic medication, using the opiate drug not for euphoric effect but for its analgesic properties

Although the author has recommended drugs and dosages individualization of the premedication is most important in this group of patients The more robust geriatric patient might very well tolerate larger doses without affecting his compensatory mechanisms However in the less robust much smaller doses than those recommended will accomplish the desired effect

The Senile Chest and Lung and Anesthesia

The geriatric patient occasionally (10 per cent) develops a senile type of emphysema which is not associated with any obstructive component There is little impairment in pulmonary function and this does not create a problem for the anesthesiologist A still smaller percentage of patients in this age group have an obstructive form of emphysema which is usually secondary to bronchial asthma bronchiectasis sarcoidosis and chronic pulmonary infection Cor pulmonale which is secondary to the obstructive form of emphysema and occurs in the latter stages of this disease creates the serious problems for the anesthesiologist and requires astute management The disease in lung parenchyma and the associated pulmonary shunting of blood seriously upset the alveolar-capillary ratio These changes in the pulmonary circulation leave these individuals with large areas of pulmonary tissue in which there is no gas exchange Their main deficit in respiration is the inability to remove CO_2 adequately and the pCO_2 level is usually elevated

All anesthetic agents produce respiratory depression and if ventilation is not properly *augmented* they will further decrease the impaired respiratory gas exchange that may exist in this age group

In recent times anesthesiologists have become quite aware of respiratory depression during the anesthetized state and the decrease in pulmonary function associated with the state itself Increasing efforts are being made to maintain adequate alveolar ventilation by means of controlled manual or mechanical ventilation and assisted ventilation In the former respiration is completely taken over for the patient so that rate and depth of ventilation are regulated by the anesthesiologist, in the latter the patient sets his own respiratory rate and the anesthesiologist augments the tidal exchange In both situations the augmented ventilation is accomplished by applying a positive pressure during the early inspiratory phase of the respiratory cycle One must attempt to keep the mean airway pressure as close to 1 to 2 cm H_2O as possible so as to affect minimally or not at all the circulation secondary to the attempts to provide adequate ventilation Mean airway pressures much above 2 cm H_2O tend to decrease pulmonary blood flow This of course will result in a decrease in cardiac output and a fall in systemic blood pressure

Although modern anesthesia apparatus has been designed to have minimal dead space and minimum resistance to gas flow the anesthesiologist must overventilate these individuals in order to maintain partial pressures of carbon dioxide which are not detrimental Some geriatric patients who have severe obstructive emphysema have become CO_2 adapted so that forced ventilation may stop their respiratory drive because of a fall in pCO_2 below the elevated CO_2 threshold of their respiratory centers If the patient s oxygen tension had been low and it becomes elevated due to a high oxygen percentage in the anesthetic atmosphere there is no hypoxic stimulus to the peripheral carotid body mechanism and apnea ensues This apnea of course is of little consequence during the period of anesthesia because ventilation can be accomplished easily by the anesthesiologist but one must be concerned about these patients when they are allowed to return to their own respiratory drives Although theoretically this is a dangerous period in the anesthetic management the

author has run into no difficulty in the early postoperative period even in CO adapted patients. However one must be sure they are ventilating well on their own before they are removed from the anesthesia machine and allowed to breathe room air in the recovery room if they remain pink. Patients with secondary cor pulmonale are a greater hazard during the anesthetized state because one must attempt to maintain adequate pulmonary and cardiac compensation. Circulatory compensation is subjected to an added stress during the anesthetic state for many reasons related to the surgery, e.g. position of the patient and the change in circulation associated with the effect of the anesthetic itself.

Positive pressure must be administered with care in the patient with severe emphysema because of the danger of rupture of an emphysematous bleb on the surface of the lung. Frequently under these circumstances a bronchopleural fistula will be created and a tension pneumothorax will develop. Diminution in respiratory exchange will occur progressively and with the mediastinal shift that will result circulatory collapse will ensue. Puncture of the chest to relieve the pneumothorax, preferably with a surgical incision rather than a needle puncture, will avert a catastrophe.

Preparation of the Patient with Pulmonary Disease for Anesthesia

Patients with emphysema, chronic bronchitis, bronchiectasis, lung abscess or pulmonary fibrosis may be helped greatly by increasing their ventilatory capacity in the preoperative period.

Such measures as epinephrine nebulization into the tracheobronchial tree will be a great help. This agent will help to dilate the bronchi and increase the respiratory gas exchange.

Detergent aerosols will frequently liquefy tenacious secretions and allow them to be coughed up before the patient is anesthetized. Large amounts of secretions in the tracheobronchial tree can be most disturbing to the anesthesiologist, because they interfere with proper ventilation and make for partial respiratory obstruction throughout the anesthesia. Frequent suctioning of the patient may make the level of central nervous system depression vary widely during the anesthetic maintenance.

Posture of the patient can also be a great help in draining pulmonary secretions before surgery. The patient should be instructed several days before anesthesia and operation to lie over his bed with his head down to provide drainage of secretions. This should also be done the morning of surgery to clear the tracheobronchial tree immediately prior to anesthesia.

Patients with acute infections of the upper respiratory tract or infections in the lower tract such as lobar or bronchopneumonia should not be anesthetized for elective surgical procedures. Emergency surgery must proceed despite the possible morbidity or mortality that may occur.

The Senile Circulation and Anesthesia

Arteriosclerosis goes hand in hand with the aging process and is present to some degree in each individual above the age of 60 years. If the patient has maintained cardiac compensation during his daily activities, arteriosclerotic heart disease of itself does not increase the hazard of anesthesia. There is no doubt that in stressful situations these patients do not maintain circulatory compensation as well as younger patients without arteriosclerosis. However over all they tolerate light levels of anesthesia (see section on The Concept of Anesthetic Depth) remarkably well. In association with arteriosclerosis, hypertensive cardiovascular disease is frequently found. However if the hypertension does not exceed 200 mm of mercury there appears to be no evidence that the patient will not tolerate a well conducted anesthesia. But if a patient is in a state of cardiac decompensation or is in a phase of incipient decompensation his tolerance for anesthesia will be poor. Anes

thesia with its depression to myocardial function and its peripheral dilatory effect on the arteriolar and capillary bed will be sufficient to intensify the cardiac failure or unmask the incipient decompensation on the operating table Occasionally under emergency conditions circulatory decompensation is present and surgery must be performed In this situation anesthesia is most hazardous and may produce sufficient circulatory derangement to further decrease cardiac filling and cardiac output This may result in ventricular fibrillation or cardiac arrest

Treatment for cardiac decompensation during anesthesia should include elevation of the trunk to the semisitting position thus lowering the venous pressure and removing some of the load from the failing heart Tourniquets placed on all four extremities and rotated every 15 minutes will act as a bloodless phlebotomy and further decrease the cardiac strain by reducing effective circulating blood volume The anesthesia should be performed with at least twice the ambient oxygen in the inspired mixture and positive pressure should be applied to the inspiratory phase of the respiratory cycle to decrease pulmonary hypoxia if present If a suitable ventilator is available a negative expiratory phase may be of some advantage The patient should be rapidly digitalized despite the risk of overdigitalization Morphine sulfate so commonly used for pulmonary edema secondary to cardiac failure should not be used before or during the anesthesia to relieve the edema The circulatory depression produced by morphine is so deleterious to the anesthetized patient that it outweighs any advantages

Frequently in this age group the electrocardiogram indicates the presence of coronary artery disease However if the patient has no symptoms of coronary insufficiency he usually withstands anesthesia without event If associated with coronary artery disease the patient has cardiac symptoms or a full blown angina pectoris the danger from anesthesia rises considerably

During the anesthetic period a coronary occlusion may occur in which case cardiovascular collapse may suddenly ensue However it may be difficult to determine the cause of the collapse since either acute blood loss or a cerebral vascular accident may produce the same picture during the anesthetic state, i e a sudden fall in blood pressure and a sudden rise in pulse rate

A previous coronary occlusion by history and electrocardiographic confirmation is indeed of serious import If this has occurred at least 3 to 6 months before operation the regimen can be so designed that the anesthetic risk is low However elective surgery should not be entered into lightly but only after careful consideration among surgeon anesthesiologist and patient Coronary occlusion of recent origin within a 3 month period is a definite added risk for anesthesia both during the anesthesia and in the early postoperative period even with excellent anesthetic management

If a patient in the geriatric group gives a history of or has an arrhythmia his electrocardiogram should be monitored throughout the anesthesia by means of a suitable oscilloscope Single auricular premature contractions wandering pacemaker and sinus arrhythmia appear not to increase the anesthetic risk The chronic auricular fibrillator well controlled with a digitalis glycoside also usually does well during anesthesia and although an increased risk usually does not change his rate or cardiac rhythm However one should be extremely wary of a patient with a history of acute auricular fibrillation and if at all possible the operation and anesthesia should be postponed until a thorough cardiac investigation is made The onset of acute auricular fibrillation during the anesthesia means that cardiac failure is imminent and surgery and anesthesia should be terminated as quickly as possible However one must be wary of patients with premature ventricular contractions because in a stressful situation and under anesthesia ventricular tachycardia and fibrillation may develop

Heart blocks are of more serious import However, a well established bundle branch block, even though a serious lesion of the conducting system does not seriously increase the risk from anesthesia

The patient with acquired complete atrioventricular block is a grave risk for anesthesia as cardiac arrest during surgery is likely to occur These patients actually develop Stokes Adams attacks during the anesthesia Prophylaxis before the induction of anesthesia is most important This can be accomplished in two ways The first is the administration of 1 to 2 mg of atropine sulfate prior to anesthesia with repeated doses every 2 hours during the surgery This tends to block the vagal influence which may slow the heart and lead to cardiac arrest The second is to use a sympathomimetic amine, such as isoproterenol This drug can be given in doses of 5 to 10 mg 2 to 4 hours before anesthesia and during anesthesia by continuous drip medication in a 4 mg per liter dilution The cardiac activity should be monitored continuously during the anesthesia to determine arrest or increase in ventricular irritability early so that they can be treated quickly A cardiac pacemaker standing by in the operating room should be mandatory Individuals with both acquired and congenital heart disease in this age group frequently are in the decompensation phase of their disease Anesthesia constitutes a real risk and should be entered into not lightly but only with adequate deliberation for the necessity of the surgery involved

Preparation of the Cardiac Patient for Anesthesia

One of the greatest risks in anesthesia is the cardiac patient who has not been suitably prepared for surgery as these patients are often in incipient decompensation It is most important to remove all the fluid possible by suitable diuretics so that the patient may have a stable dry weight before surgery

The patient's digitalization should have been well established Recent digitalization may produce an overdose of drug which makes the heart more prone to serious arrhythmias If the digitalization is done slowly and the patient placed on a maintenance dose of this drug and observed carefully, he will be a much better anesthetic risk than if his digitalis management has been haphazard

THE CHOICE OF THE ANESTHETIC SYSTEM

Inhalation

Open System

The open system commonly called the open drop method is suitable only for the volatile vapors At one time it was considered the safest system in anesthesia especially for the critically ill or the geriatric patient It is probably the least desirable of all the anesthetic systems available for the geriatric patient The percentage of oxygen in the inspired atmosphere necessarily must be below the normal percentage of oxygen in ambient air as part of it is replaced by the anesthetic vapor

The anesthesiologist has no control of the depth or rate of respiration and the patient's CO_2 may vary widely in response to wide changes in respiratory minute volume The pCO_2 and the pO_2 may vary markedly In the geriatric patient with preexisting pulmonary pathology the swing in the partial pressure of the respiratory gases can be marked and may lead to acidotic states with associated electrolyte shift These shifts in electrolytic balance related to inadequate ventilation during anesthesia may lead to a gradual downhill course and early death in spite of the best therapy It is true that the open system has some good features in that it adds little or no dead space and no resistance to respiration However the lack of control of ventilation far outweighs these good features

Some have advocated the use of this open system in the patient past 60 who has an elevation in body temperature as a means of losing heat through the respiratory tract

Patients with overwhelming infection with high body temperature frequently lose their ability to perspire This is related to a de pression of the central heat regulatory mech anism The only pathway for heat loss under these circumstances is the respiratory tract The open system allows this last avenue of heat escape to remain open whereas closed system anesthesia closes it However mod ern cooling techniques are far more efficient in controlling body temperature than the open system Therefore it has little or no place as a system for the geriatric patient in situations where the modern anesthesiologic armamentarium is at hand and the anes thesiologist is available to use it

Semiopen System

The semiopen system uses the same equipment as the open system except that some occlusive material is placed about the face mask to develop a higher concentration of anesthetic under the mask The semiopen system has the same advantages and disad vantages as the completely open system but because of the occlusive material about the face mask accumulation of carbon dioxide is greater than in the open system The dan gers and the sequelae produced are the same as those in the open system but greater in magnitude Therefore semiopen systems have no place in geriatric anesthesia

Semiclosed System (Partial Rebreathing)

The semiclosed system uses the anesthetic machine which has an inspiratory and ex piratory pathway In this system the major ity of the exhaled gases escape into the atmosphere through a suitable expiratory valve The semiclosed system can be used with both the volatile vapors and the gases and has wide application for the geriatric patient These techniques allow accurate control of the inspired oxygen and the anes thetic agent and a good method of carbon dioxide removal through suitable expiratory valves Because of their poor musculature and pulmonary patholo_y older patients have some difficulty in moving valves in the anesthetic system However with the low-resistance valves available in modern anes thetic machines this is no longer a problem Fast flow techniques associated with alkali carbon dioxide absorption adequately take care of the carbon dioxide excreted by these patients

Complete Non rebreathing Systems

Complete non rebreathing systems have some advantage over the semiclosed partial rebreathing system described above in that they keep all the expiration from returning to the inspiratory mixture This of course maintains the inspiratory mixture constant and all the CO rich exhalation escapes into the atmosphere and is readily removed from the body Valves of the Stephen Slater and Lewis Leigh type allow assisted or con trolled ventilation in which the anesthesiolo-gist at a moment s notice can augment the respiratory exchange

Closed Systems

In the closed system all the inspiratory and expiratory gases are rebreathed with the exception of carbon dioxide which is re moved by a suitable absorbent Closed sys tem anesthetic techniques are the most com monly used for the geriatric patient Recent improvements in decreasing resistance and dead space in the closed anesthesia machine together with presently available Elam Brown carbon dioxide absorbers with almost 100 per cent efficiency make this system suitable for the geriatric patient Assisted or controlled respiration can be accomplished at will

This system should be used only with agents of high or intermediate potency If one attempts to use this system with agents of low potency in which the oxygen content of the inspired mixture is barely enough for metabolic needs hypoxia may ensue The inert agent will accumulate in the rebreath ing mixture and a fall in oxygen content below the critical level for adequate oxygen saturation of the body will ensue However when the potent anesthetic agents are used

Heart blocks are of more serious import. However, a well established bundle branch block, even though a serious lesion of the conducting system, does not seriously increase the risk from anesthesia.

The patient with acquired complete atrioventricular block is a grave risk for anesthesia as cardiac arrest during surgery is likely to occur. These patients actually develop Stokes-Adams attacks during the anesthesia. Prophylaxis before the induction of anesthesia is most important. This can be accomplished in two ways. The first is the administration of 1 to 2 mg of atropine sulfate prior to anesthesia with repeated doses every 2 hours during the surgery. This tends to block the vagal influence which may slow the heart and lead to cardiac arrest. The second is to use a sympathomimetic amine such as isoproterenol. This drug can be given in doses of 5 to 10 mg 2 to 4 hours before anesthesia and during anesthesia by continuous drip medication in a 4 mg per liter dilution. The cardiac activity should be monitored continuously during the anesthesia to determine arrest or increase in ventricular irritability early so that they can be treated quickly. A cardiac pacemaker standing by in the operating room should be mandatory. Individuals with both acquired and congenital heart disease in this age group frequently are in the decompensation phase of their disease. Anesthesia constitutes a real risk and should be entered into not lightly but only with adequate deliberation for the necessity of the surgery involved.

Preparation of the Cardiac Patient for Anesthesia

One of the greatest risks in anesthesia is the cardiac patient who has not been suitably prepared for surgery, as these patients are often in incipient decompensation. It is most important to remove all the fluid possible by suitable diuretics so that the patient may have a stable dry weight before surgery.

The patient's digitalization should have been well established. Recent digitalization may produce an overdose of drug which makes the heart more prone to serious arrhythmias. If the digitalization is done slowly and the patient placed on a maintenance dose of this drug and observed carefully, he will be a much better anesthetic risk than if his digitalis management has been haphazard.

THE CHOICE OF THE ANESTHETIC SYSTEM

Inhalation

Open System

The open system, commonly called the open drop method, is suitable only for the volatile vapors. At one time it was considered the safest system in anesthesia, especially for the critically ill or the geriatric patient. It is probably the least desirable of all the anesthetic systems available for the geriatric patient. The percentage of oxygen in the inspired atmosphere necessarily must be below the normal percentage of oxygen in ambient air, as part of it is replaced by the anesthetic vapor.

The anesthesiologist has no control of the depth or rate of respiration, and the patient's CO_2 may vary widely in response to wide changes in respiratory minute volume. The pCO_2 and the pO_2 may vary markedly. In the geriatric patient with preexisting pulmonary pathology, the swing in the partial pressure of the respiratory gases can be marked and may lead to acidotic states with associated electrolyte shift. These shifts in electrolytic balance related to inadequate ventilation during anesthesia may lead to a gradual downhill course and early death in spite of the best therapy. It is true that the open system has some good features in that it adds little or no dead space and no resistance to respiration. However, the lack of control of ventilation far outweighs these good features.

Some have advocated the use of this open system in the patient past 60 who has an elevation in body temperature as a means of losing heat through the respiratory tract.

Patients with overwhelming infection with high body temperature frequently lose their ability to perspire This is related to a depression of the central heat regulatory mechanism The only pathway for heat loss under these circumstances is the respiratory tract The open system allows this last avenue of heat escape to remain open whereas closed system anesthesia closes it However modern cooling techniques are far more efficient in controlling body temperature than the open system Therefore it has little or no place as a system for the geriatric patient in situations where the modern anesthesiologic armamentarium is at hand and the anesthesiologist is available to use it

Semiopen System

The semiopen system uses the same equipment as the open system except that some occlusive material is placed about the face mask to develop a higher concentration of anesthetic under the mask The semiopen system has the same advantages and disadvantages as the completely open system but because of the occlusive material about the face mask accumulation of carbon dioxide is greater than in the open system The dangers and the sequelae produced are the same as those in the open system but greater in magnitude Therefore semiopen systems have no place in geriatric anesthesia

Semiclosed System (Partial Rebreathing)

The semiclosed system uses the anesthetic machine which has an inspiratory and expiratory pathway In this system the majority of the exhaled gases escape into the atmosphere through a suitable expiratory valve The semiclosed system can be used with both the volatile vapors and the gases and has wide application for the geriatric patient These techniques allow accurate control of the inspired oxygen and the anesthetic agent and a good method of carbon dioxide removal through suitable expiratory valves Because of their poor musculature and pulmonary pathology older patients have some difficulty in moving valves in the anesthetic system However with the low resistance valves available in modern anesthetic machines this is no longer a problem Fast flow techniques associated with alkali carbon dioxide absorption adequately take care of the carbon dioxide excreted by these patients

Complete Non rebreathing Systems

Complete non rebreathing systems have some advantage over the semiclosed partial rebreathing system described above in that they keep all the expiration from returning to the inspiratory mixture This of course maintains the inspiratory mixture constant and all the CO_2 rich exhalation escapes into the atmosphere and is readily removed from the body Valves of the Stephen Slater and Lewis Leigh type allow assisted or controlled ventilation in which the anesthesiologist at a moment s notice can augment the respiratory exchange

Closed Systems

In the closed system all the inspiratory and expiratory gases are rebreathed with the exception of carbon dioxide which is removed by a suitable absorbent Closed system anesthetic techniques are the most commonly used for the geriatric patient Recent improvements in decreasing resistance and dead space in the closed anesthesia machine together with presently available Elam Brown carbon dioxide absorbers with almost 100 per cent efficiency make this system suitable for the geriatric patient Assisted or controlled respiration can be accomplished at will

This system should be used only with agents of high or intermediate potency If one attempts to use this system with agents of low potency in which the oxygen content of the inspired mixture is barely enough for metabolic needs hypoxia may ensue The inert agent will accumulate in the rebreathing mixture and a fall in oxygen content below the critical level for adequate oxygen saturation of the body will ensue However when the potent anesthetic agents are used

in closed systems one must be extremely careful of anesthetic overdose As will be mentioned in the section on The Concept of Anesthetic Depth it is extremely easy to overdose older persons and their resuscitation may be difficult However, in the hands of the competent anesthesiologist this is an excellent system for the geriatric patient

THE CHOICE OF AN ANESTHETIC TECHNIQUE

Inhalation Techniques

Inhalation techniques can be used with the anesthetic face mask or via an endotracheal tube In the older age group the endotracheal route is to be preferred for all surgery in body cavities A face mask without endotracheal intubation may be used for short operations involving the skin muscle or fascial layers of the body surface provided an unobstructed airway can be maintained by the simple placement of an oropharyngeal airway Mask techniques require varying amounts of pressure on the face in order to maintain a good fit between the face body and the mask The skin of older persons is extremely susceptible to pressure effects burns and even necrosis especially when the mask is used for a number of hours To avoid these undesirable effects of the face mask the endotracheal tube should be introduced soon after the anesthetic induction if it is to be used electively

Many elderly patients are edentulous and relaxation of the pharyngeal wall is common thus providing an ideal setting for upper respiratory obstruction This is one group of patients where respiratory obstruction of a minor degree is fraught with major complications The edentulous geriatric patient is in a way akin to the edentulous newborn baby in that elevation of the jaw by pressure on the point of the chin usually makes for complete obstruction at the lips The endotracheal tube prevents this

It is desirable to reduce the anatomic dead space as much as possible and the endotracheal tube is an excellent method of reducing the dead space of the mouth and pharynx Reduction in dead space will reduce the resistance to respiration which is of extreme importance in this age group

As in any age group the properly used endotracheal tube provides a completely patent airway prevents aspiration of gastric contents, and gives a ready pathway for suctioning of secretions from the tracheobronchial tree The geriatric patient frequently has very tenacious secretions because of chronic bronchitis and their removal during the anesthetic and immediately at the close of surgery is a great help in decreasing pulmonary complications during the postoperative period This can be done best via the endotracheal tube

It is true that endotracheal anesthesia probably adds an additional risk from trauma at the time of intubation and from the presence of a foreign body in the trachea However the advantages of the unobstructed airway and the protected tracheobronchial tree far outweigh the disadvantages related to trauma produced by the endotracheal technique when used by competent personnel

In all surgery except where simple regional methods can be used inhalation anesthetic techniques are to be preferred for this age group of patients The inhalation agents are not metabolized in the body and are excreted unchanged by way of the lungs thus no drug accumulates in the body awaiting detoxification The level of central nervous system depression can be changed rapidly by simply removing the agent from the inspired mixture desaturation begins immediately In time of circulatory or respiratory difficulty this is ideal If one uses techniques involving depot drugs such as those used for intravenous subarachnoid or epidural techniques this is not possible These agents must be released from depot and detoxified at specific constant rates

Intravenous Techniques

The intravenous technique is the simplest of the techniques to use as it requires only

a venipuncture and an agent to push the drug into the circulation However, all the intravenous anesthetic agents in vogue require a phase of metabolism and detoxification within the body by various organ systems Because of this fact and because the geriatric patient frequently has decreased liver and kidney function he handles these drugs slowly and frequently ineffectively This is disadvantageous as the drug action may be unduly prolonged which increases the complications during the postanesthetic phase Prolonged drug effect means the patient moves about in bed less than he would if the drug effect had worn off completely In these patients immobility invites pneumonia and atelectasis It also appears logical that immobility invites the formation of thrombi and subsequent embolization Prolonged effect depresses ventilation resulting in hypoxia or hypercapnia, or both As stressed elsewhere in this chapter these factors may lead to the death of the patient

If the intravenous preparations are used in this age group they should be used only for operations of short duration or as inducing agents before the introduction of inert gases or vapors Under such circumstances a small quantity of drug will be presented to the body for detoxification and prolongation of drug action will be prevented

Regional Techniques

Regional techniques have an important place in the anesthesia for geriatric patients These include those techniques in which a local anesthetic agent is placed in close proximity to a nerve or its terminal Topical methods are accomplished by the direct application of the local anesthetic on mucous membranes Local infiltration is produced by injecting the local anesthetic throughout the tissue to be excised Nerve block techniques place the anesthetic along the course of a nerve and anesthesia results distally from the blocked area Epidural block is produced by placing the anesthetic solution between the ligamentum flavum and the dural tube in the thoracic and lumbar area or via the caudal canal in the sacrococcygeal area Spinal anesthesia is produced by placing the anesthetic agent in the subarachnoid space However regional techniques are not without some disadvantages

Local anesthetics especially in this age group should be used in minimal effective concentrations, frequently in much lower concentrations than one would think would be effective The usually used 1 per cent procaine hydrochloride can be reduced to a 0 5 per cent without losing effective analgesia This reduction in concentration will allow greater volumes of solution to be used without toxicity e g , 100 to 150 cc of 1 per cent procaine hydrochloride or 200 to 300 cc of 0 5 per cent procaine hydrochloride Injection should be slow and the quantity of anesthetic used should be given over a fairly long period of time so as not to increase the blood level to the toxic point

The geriatric patient appears to develop toxic reactions with lower doses than his younger counterpart so one must be ever aware of either the central stimulating type of reaction marked by irritability apprehension and convulsion and the circulatory reaction where the blood pressure falls precipitously It is also important to observe the patient's ability to respond to spoken voice, as frequently the first sign of toxic reaction will be an intense desire to sleep When a patient suddenly becomes unresponsive or difficult to arouse the anesthesiologist should suspect that he is developing a toxic reaction to the local anesthetic

If a toxic reaction manifested by central irritative phenomena does occur oxygen by mask and an intravenous barbiturate should be used The barbiturate should be injected slowly until the irritability or convulsions cease Apnea may ensue, so artificial ventilation may be necessary until spontaneous respiration returns This entire procedure may have to be repeated if the convulsions recur

Circulatory collapse should be treated with an intravenous vasopressor and oxygen If response of the circulation is not prompt

massage of the heart may be the only life saving measure

Local infiltration or nerve block anesthesia fills a big need in this age group and can be used with ease for operations on the surface of the body or on the extremities Occasionally it is the technique of choice by exclusion because all other techniques available today will hasten the patient s death

Epidural block has a definite place for the geriatric patient producing less circulatory derangement than a subarachnoid block to the same level The epidural block of course must be done by an experienced person lest the neophyte introduce a massive subarachnoid block inadvertently This technique is rarely if ever specifically indicated

Caudal block is a form of epidural block The caudal canal and the epidural space are continuous so that if sufficient solution is placed in the caudal canal it will rise in the epidural space This is an ideal regional block for operations about the rectum in this age group as there is little or no change in the dynamics of the circulation It must be remembered that the dural tube ends at the second sacral vertebra and again care must be taken lest a massive subarachnoid anesthesia be introduced

Subarachnoid block or spinal analgesia can be used with great advantage in this age group in operating on the lower extremities and in the regions below the umbilicus With their rigid circulatory systems older persons are frequently unable to compensate adequately for the loss of peripheral sympathetic control due to subarachnoid anesthesia especially if the block is to the upper thoracic region Sharp falls in blood pressure occur if this amount of sympathetic paralysis is induced It is true that this hypotension can be controlled by appropriate vasopressor medication but if one can induce satisfactory anesthesia by other methods which are less likely to produce changes in circulation they are to be preferred The peripheral blood pressure may be raised by appropriate sympathomimetic amines However the vasopressor drug may be constricting other vascular beds producing a decrease in blood flow to vital organs while one may be lulled into a sense of security because the brachial arterial pressure is within normal range

The Concept of Anesthetic Depth

Until recently it was felt that a moderately deep degree of surgical anesthesia protected the body from the noxious stimulus of surgery and that lighter levels of anesthesia above Guedel s stage of surgical anesthesia were fraught with the danger of sudden catastrophe—ventricular fibrillation and cardiac arrest However from the work of many authors it now appears that conventional levels of surgical anesthesia regardless of the anesthetic agent used are depressing both to ventilation and to all the components of the circulation From the standpoint of respiration there is a decrease in effective alveolar ventilation and from the standpoint of the circulation there is a decrease in the cardiac output from a direct effect of the anesthetic agent on the myocardium There is also a profound paralysis of peripheral compensatory mechanisms on the arterial and venous sides of the circulation

There has evolved a modern concept of anesthetic depth supporting the hypothesis that the lightest degree of central depression that one can produce compatible with the surgical operating conditions is the least upsetting to the body physiology This is most important in the geriatric patient, as these patients have such a small margin of safety that both their ventilatory and circulatory systems can tolerate only minimal stress Deeper levels of surgical anesthesia in this group show profound effects on the patient s homeostasis

The concept of minimal central nervous system depression is true not only for the administration of the anesthetic itself but also in the preanesthetic preparation of the patient Heretofore large doses of opiate and barbiturate medication were given to these patients rather haphazardly with little

thought to individualization Thus the pre medication which was aimed at psychic se dation produced profound depression to both ventilation and circulation of the patient which was evident upon his arrival in the anesthesia induction room

It is most important that the drugs used to relieve anxiety and the apprehension of the coming surgical procedure be gradually reduced in this age group in contrast to the amount that would be used in the middle aged group How is one best to accomplish this minimal level of central nervous system depression satisfactorily in this age group? This question is best answered by each anesthesiologist because of his familiarity with specific agents and techniques How ever, the author believes the hypothesis that peripheral muscular relaxation is more advantageously provided by a peripheral muscle relaxing drug than by profound cen tral nervous system depression

It is important to caution the surgeon that the anesthesiologist can provide satisfactory operating conditions under these minimal levels of depression if the operator is gentle in handling tissue The gentle surgeon who produces traction on body structures slowly but firmly will be able to operate extremely satisfactorily under these conditions If the surgeon is rough and makes traction on structures suddenly and forcefully he will find it extremely difficult to operate under these conditions Gentle handling of tissues in association with minimal anesthetic de pression will be important in decreasing the complications in the postoperative period that were so prevalent in the past because of profound degrees of central nervous system depression by anesthetic agents and tech niques

The logical question of course comes to mind Can the anesthesia be too light? The author believes that the answer to this ques tion is yes

It appears that one needs two components for safe adequate operating conditions these are amnesia and analgesia However uncon sciousness or better unawareness of en vironmental stimuli is not a necessary pre requisite Weak anesthetic agents of the potency of nitrous oxide when used with a muscle relaxant may not provide both the necessary elements The author does not believe that amnesia alone meets the safe prerequisites It is felt that unblocked afferent pain impulses are detrimental to the organism The potent anesthetic agents used in the analgesia stage of anesthesia do provide easily controlled analgesia and amnesia but we still need a new agent that is more potent than nitrous oxide but that will lack the dan gerous potency of cyclopropane or diethyl ether

SELECTION OF THE ANESTHETIC

The Volatile Vapors

Chloroform ($CHCl_3$) is a 100 per cent potent anesthetic agent and because of its great potency, accidental overdose is a defi nite hazard Respiratory and cardiovascular overdose occur almost simultaneously and resuscitation of the patient may be difficult or impossible Because few persons in this country have facility with chloroform and because of its possible damaging effect on liver function the author feels that chloro form has little place in the surgery of geriatric patients

Recent evidence indicates that if chloro form is given in the setting of adequate ven tilation so that hypoxia and hypercapnia are prevented liver damage is not produced

Fluothane ($CF_3CHClBr$) a 100 per cent potent anesthetic agent is the newest of the volatile vapors It was introduced as a po tent nonexplosive nonflammable anesthetic agent Fluothane has all the drawbacks of chloroform and adds nothing new to our armamentarium It only provides another extremely potent agent where the margin is narrow between safe anesthesia and cardio vascular collapse and death It is being used to reinforce nitrous oxide–oxygen anesthesia Because of its great potency it has little to

offer as a sole agent for safe anesthesia in geriatric surgery

Diethyl ether ([C H] O) the oldest of the volatile vapors a 100 per cent potent anesthetic agent also is potentially dangerous because of accidental overdose However the dose that produces respiratory arrest with ether does not have the same profound cardiovascular depression as is frequently seen under similar circumstances with chloroform This agent can be used in doses to effect an easily maintained and controlled level of analgesia Of the presently available agents capable of producing the analgesic level of anesthesia diethyl ether is the least disturbing to the physiology of the body The cardiac contractile force and the cardiac output are excellent during ether anesthesia because of the sympathetic discharge stimulated by diethyl ether It is the anesthetic agent of choice in patients with cardiac irregularities as it tends to stabilize the conducting system by its vagal blocking action The epinephrine and norepinephrine production is also beneficial in producing dilation of the bronchi which aids in respiratory gas exchange It is an excellent agent for the asthmatic patient for the same reason Diethyl ether is very useful in the geriatric patient

Divinyl ether (CH_2 CH O CH CH) a potent rapid acting volatile vapor rarely has a place in anesthesia for the geriatric patient except perhaps for anesthetics of 5 to 10 minutes duration One must be extremely careful of overdose An anesthetic of more than 30 minutes duration may invite serious liver damage

Ethyl chloride (CH_3 CH Cl) has no place in the anesthesia of the geriatric patient because of its rapid potent action and its severe depressant action on the heart which is similar to that of chloroform

Trichlorethylene (CHCl CCl) if used as an adjuvant to nitrous oxide–oxygen can be used with safety in this age group as a light level of analgesia similar to that with diethyl ether can be maintained Trichlorethylene should not be used as a sole agent with oxygen in the geriatric patient Cardiac irregularities and rapid shallow respiration occur when this drug is used in sufficient concentration to produce surgical anesthesia

The Anesthetic Gases

Nitrous oxide (N O) is an inert inorganic gas of minimal potency In the past it was limited to short operations on the surface of the body or as an inducing agent before a potent anesthetic vapor With the introduction of the muscle relaxants into anesthesia no longer was profound central nervous system depression necessary for peripheral muscle relaxation Now the use of nitrous oxide is almost unlimited Because of this agent s low potency adequate ventilation could be maintained without fear of over dose Whether it has sufficient analgesic potency to be used in this way as a sole agent is controversial It is nonexplosive and non flammable and is ideal for use in the presence of cautery or electrical apparatus It can be safely used with a muscle relaxant in this age group

Ethylene (C H_4) a weak anesthetic hydrocarbon has the same advantages and disadvantages as nitrous oxide However it is highly explosive and flammable and thus there is some hazard with techniques that allow this agent to escape into the operating room atmosphere

Cyclopropane (C_3H_6) a 100 per cent potent anesthetic hydrocarbon has a definite place in the surgery of these patients It has a rapid onset there is rapid recovery and the controllability of the depth of central nervous system depression is good The post operative hypotension that is sometimes seen following the use of this drug could theoretically be dangerous to the arteriosclerotic group A differential diagnosis among various other causes of hypotension must be made but when all others have been ruled out the author allows the patient gradually to readjust his circulation These patients are warm dry and pink they have a slow pulse and give the appearance of well being

Some clinics restore the blood pressure with an appropriate vasopressor, but the author does not believe this is necessary and it may be hazardous from the standpoint of the vasoconstriction produced in vital lesser circulations However in The New York Hospital-Cornell Medical Center adverse effects from the hypotension have not been noted following the end of this anesthetic The occasional postanesthetic delirium that is seen following cyclopropane may result in injury of older persons secondary to thrashing about in bed We do not know precisely the cause of this delirium but we believe it results when the patient suddenly becomes aware of pain while he is still disoriented as to time and place Since the author feels that this is a phenomenon resulting from painful stimuli an intravenous opiate has been the treatment Morphine sulfate 5 to 7 mg or Demerol 25 to 50 mg has usually been sufficient to control this delirium The possibility of postoperative delirium is not a contraindication to its use

Because of the agent s vagomimetic effect it should not be used for (1) patients with a history of or an existing cardiac irregularity (2) in the presence of a prolonged P R interval (3) simultaneously with epinephrine or (4) in the asthmatic patient From the standpoint of type of surgery pheochromocytoma is its only contraindication because of the large amount of circulating epinephrine that may be present owing to manipulation of the tumor

The Intravenous Barbiturates

Several intravenous barbiturates are available today However they offer nothing to choose from over the older thiopental (Pentothal) sodium They should be confined to use as an inducing agent before an anesthetic gas or vapor or for operations of relatively short duration Wherever possible they should be used to induce sleep rather than having the conscious patient breathe a gas or vapor under a face mask All thiobarbiturates in vogue today require a phase of detoxification and a fixed rate of excretion from the body The geriatric patients processes of detoxification may be depressed and thus prolongation of drug action may be seen

Rectal Hypnotics

Tribromoethanol (Avertin) has no place in the management of geriatric anesthesia It is a far too potent respiratory and circulatory depressant for any advantage one might get from its use as a basal anesthetic

ANESTHESIA AND BLOOD VOLUME

In the geriatric age group patients frequently have anemias which have escaped detection and these may be quite profound when discovered Anemias may be associated especially with poor dietary intake They are usually iron deficiency anemias and can be corrected by appropriate iron therapy However these anemias may be due to chronic blood loss and if the hemoglobin is below 10 Gm or the hematocrit is 35 or below transfusion should be performed before anesthesia If uncorrected the anemia due to chronic blood loss may result in hypoxia during anesthesia because of the insufficient oxygen carrying capacity of the circulating blood This situation frequently may be aggravated by diminution in ventilation due to depression caused by the anesthesia

In patients who have been chronically ill and incapacitated or on prolonged bed rest an unrecognized hypovolemia may be present The hemoglobin blood pressure and pulse may be within the normal ranges However with the onset of anesthesia and its resultant peripheral vasodilatation the hypovolemic state may be suddenly unmasked as shown by a sudden fall in blood pressure and increase in heart rate Prior to anesthesia the patient may have been maintaining adequate compensation for his hypovolemia by a contracted vascular bed and the available circulating blood volume was therefore adequate to maintain vital signs within normal limits However, the periph

eral dilatation due to anesthesia removed these compensatory mechanisms and the hypovolemic state is suddenly unmasked

The diagnosis of chronic shock or chronic hypovolemia may be difficult to make at the beginning of anesthesia but it is one which must be thought of in the geriatric patient when one encounters a sudden fall in blood pressure and increase in heart rate shortly following the establishment of surgical anesthesia These changes in vital signs may be related to other phenomena but chronic hypovolemia must be on the list of possibilities The treatment of course is whole blood replacement associated with lighter levels of anesthesia to decrease the amount of peripheral dilatation due to anesthetic depth This blood replacement must be handled judiciously to avoid overloading the circulation as frequently these patients have a damaged myocardium

Acute blood loss at the time of surgery must be replaced as it occurs It is a poor policy to wait until the pressure falls or the pulse rises before giving whole blood It is more difficult to correct induced hypotension once it has occurred than it would have been to prevent it To be sure whole blood should never be used where it is not necessary because of the dangers inherent in whole blood transfusion However if excessive whole blood loss is observed by the method used in the particular operating room to determine blood loss replacement should be done at that time

It is quite common and usual in younger individuals that if the blood loss is sufficient to reduce effective total blood volume the pulse rate will usually rise before the pressure falls and this is an excellent sign to observe in this age group However the geriatric patient may not respond to whole blood loss with a tachycardia but the first sign of an inadequate blood volume may be a sudden fall in blood pressure

Induced hypotension is frequently used in younger patients to improve operating conditions in certain types of surgery The most popular technique today involves the use of a ganglionic blocking agent which produces a peripheral vasodilatation As previously stated geriatric patients are quite sensitive to peripheral vasodilatation and hypotensive technique should be employed only with great caution if at all in these patients Other conditions such as diabetes or renal disease in which vascular reactivity is impaired may also further increase the hazard of this technique

THE OPERATIVE POSITION AND ANESTHESIA

During the state of anesthesia with its associated relaxation of muscles an unnatural stress is placed on joints and on the bony skeleton and in the vast majority of patients this results in no increased postoperative complications However, because of a high incidence of osteoarthritis the geriatric patient frequently does show the effects of muscle relaxation and strain on the bony skeleton following anesthesia Severe back pain and pain in an extremity are fairly common postsurgical problems It therefore is most important that these patients be handled gently during anesthesia and that their extremities and vertebral column be supported while they are being moved to and from the operating table

Cervical osteoarthritis is common in this age group and it is therefore most important that the anesthesiologist prevent hyperextension of the cervical vertebrae and sudden rolling of the head If it becomes necessary to produce extreme positions of the head in order to produce an unobstructed airway in these patients it is far better to use endotracheal anesthesia regardless of the operation or its duration so that the head can be placed in the neutral position without undue strain on the cervical vertebrae which have been made rigid from the aging process

There is no doubt that these patients appear to tolerate the supine position better than any other during the anesthetic state Wherever possible this position is preferable However if the needs of surgery dic

tate other positions one must be extremely careful that the desired position be assumed slowly At the end of the procedure reposi tioning must be accomplished slowly to al low for circulatory readjustment

The lithotomy position is probably one of the most frequent surgical positions If it is assumed slowly it is tolerated fairly well However it must be remembered that pa tients in incipient congestive failure may show the effects of a sudden overload of the circulation caused by the sudden emptying of a large volume of blood from the extremi ties into the general circulation This com plication will usually manifest itself in early pulmonary edema When the patient is taken out of this position it again must be done slowly because at this time the danger lies in the rapid drainage of blood into the ex tremities This resumption of the supine position from the lithotomy position may unmask a deficient circulating blood volume which was unsuspected because of the added volume in the circulation from the elevated extremities Irrespective of whether the blood volume is sufficient the geriatric pa tient will readjust to a change in position only slowly because of arteriolar sclerosis and thus the return to the supine position should be done slowly

The lateral kidney position is another extremely stressful position for the anesthe tized patient The kidney position not only involves the lateral position but also re quires hyperextension putting both the head and the feet lower than the patient s thora columbar area Even fairly young individu als may respond to this abnormal position with hypotension and tachycardia Again it must be stressed that the older patient may show this circulatory strain solely by devel oping a hypotension This group may be unable to compensate by increasing heart rate The geriatric patient usually develops circulatory inadequacy when placed in this position It therefore is most important that the anesthetized patient be placed in the kidney position slowly with careful atten tion to blood pressure and pulse If it is obvious that the ideal operative position produces circulatory decompensation the surgeon must compromise the ideal position with a modified one which the patient will tolerate This position will very frequently unmask a decreased circulatory volume that is the cause of the hypotension but also the pressure of the broken table may be suffi cient to decrease venous return by compres sion of the inferior vena cava This produces a hypotension from decreased venous return and a decreased cardiac output Again as in the lithotomy position the change from the lateral kidney position to the supine should be assumed slowly to allow time for circula tory readjustment at the end of the surgical procedure

The lateral position usually assumed for intrathoracic procedures produces circula tory strain which becomes readily obvious in this age group If upon the assumption of the lateral position circulatory inade quacy manifests itself the position should be changed immediately and return to the supine position accomplished The surgery usually can then be accomplished in the su pine position without incident

Previous to anesthesia if one is concerned with the patient s circulatory compensation it is wise to test him by putting him in the operative position unanesthetized If he de velops circulatory inadequacy from position alone one can anticipate that this reaction will be magnified in the anesthetized state In this situation the surgeon and the anes thesiologist should agree on a modified posi tion for the surgical procedure

For abdominal surgery the supine posi tion is the one usually used and the one in which the patient appears to compensate well However during an operative proce dure in the abdomen in this age group it is important to pay careful attention to reac tions to retractors and abdominal packs Frequently reflex responses from surgical manipulation in the abdomen that the younger patient tolerates well initiate hypo tensive episodes which may be indeed detri mental to the aged patient An abdominal

pack or retractor may be just sufficient to decrease cardiac output from pressure on the vena cava thus resulting in extreme hypotension Simple readjustment of the pack usually remedies the situation

The head down or Trendelenburg position is one which must be assumed slowly to allow time for circulatory readjustment, and the amount of Trendelenburg position should be just sufficient to allow adequate operating conditions The extreme Trendelenburg position in this age group severely taxes the circulation and produces tremendous venous stasis in the cerebral circulation This position should be used just to the tolerance of the patient and must not exceed it Return to the supine position should be accomplished slowly

The prone position is required for posterior fossa craniotomies and surgery of the spinal cord and vertebral column Care should be taken that adequate ventilation is assured The emphysematous patient with a fixed rib cage depends almost completely on his diaphragm for ventilatory work and the motion of the diaphragm may be compromised in the prone position especially if the patient is obese Adequate support should be placed under the shoulders and bony pelvis to remove weight from the chest and abdomen and to assure minimum restriction of ventilation In placing support under the pelvis one should be especially careful that no pressure is placed either on the abdomen or the femoral areas since compression of the inferior vena cava or femoral veins may result in pooling of the blood in the lower portion of the body with inadequate cardiac filling diminished cardiac output and fall n blood pressure Compression of the inerior vena cava will necessitate the return f a greater proportion of the blood to the eart through the vertebral venous plexus d may be a cause of severe bleeding dur operations on the spine The use of a ebellar frame necessitates careful protec of the eyes Glaucoma may exist un gnized in many older patients and mechanical pressure on the eye may further aggravate the condition Should the mechanical pressure be sufficient to raise the intraocular tension above that of the retinal arteries there will be retinal ischemia and if this continues long enough blindness may result Protection of the eyes is even more important in those cases in which hypotension is deliberately induced since less mechanical pressure will suffice to close off the retinal blood supply

Patients undergoing frontal or parieta craniotomy often must have their heads raised in order to decrease venous bleeding The elderly patient who is deeply anesthetized will usually show a marked drop in blood pressure when his head is elevated Lightening the anesthesia may help to reverse the hypotension but usually a compromise in positioning is required to restore a normal blood pressure

Very frequently in this age group the patient arrives in the anesthesia room severely dyspneic and in order for him to breathe adequately he must be put on the operatir table in the sitting or semireclining positior He should never be made to lie flat in orde to induce anesthesia On the contrary the anesthesia should be begun in the sitting position when the patient begins to lose consciousness he will lose the subjective feeling of dyspnea and he can be graduall lowered with careful attention paid to the adequacy of the total circulation Usually the patient can be placed almost flat in the anesthetized state A good guide to the patient s tolerance of the position is observa tion of the pressure in the jugular vein If the placement of the patient in the supine position produces great dilatation of the jugular vein indicating an increase in pressure the position should be modified to decrease this jugular distention and thus remove some of the load from the damaged myocardium

Therefore the operative position in anesthesia is one of specific individual tolerance Individuals in this age group are so sensitive

to positional change because of the effects of aging on ventilation and circulation Only a trial will determine whether the patient will tolerate any given position However, if upon trial it is obvious that the position creates too great a stress, it should be changed quickly

ANESTHESIA AND DURATION OF OPERATION

With the anesthetic agents and techniques available to us the geriatric patient can be anesthetized and carried through a surgical procedure with the expectancy that at the end his physiology will be but little disturbed The above statement is as true for anesthesias of 1 hour or less as it is for anesthesias of 1 to 3 hours duration However for operations of 3 hours or longer in this age group the above statement is not as true In long anesthesias—4 5 6 and 7 hours—in spite of the best available management these patients may gradually deteriorate The blood pressure progressively falls in spite of whole blood replacement and minimal anesthetic depth The response to trauma is marked by hypotension and decreased capillary refill The patient s skin becomes pale and sweating may be an early sign We are not at all sure why this occurs However it is common to feel that too much has been done to the patient This of course varies from patient to patient in this age group some tolerating extensive and prolonged procedures However if there is evidence that the patient is deteriorating markedly in spite of good management one should seriously consider terminating the *procedure as quickly as practicable From* the anesthesiologist s point of view there are relatively few patients who cannot be anesthetized for 1 to 3 hours almost regardless of their preanesthetic condition Therefore wherever possible the surgical procedure and the anesthesia in this age group should be confined to a 2 or 3 hour limit A careful evaluation of the patient should be made if further operating time is needed

POSTOPERATIVE ANESTHETIC PROBLEMS

Postoperative Pain—Narcotics and Regional Block

Anesthetic agents and techniques have been perfected to such a degree that the patient usually is aware of his environment immediately at the end of the surgical procedure or very shortly thereafter This of course is beneficial to the patient s ventilation and circulation however, he perceives pain and reacts to pain at the same time

Treatment of postoperative pain has not advanced as rapidly as have the anesthetic techniques and we are still using drugs and methods in which potent side effects are associated with the production of analgesia

Many regional block techniques have been tried however they are time consuming They require expert application and their analgesic effects are short lived The available safe local anesthetic today, even when used in conjunction with vasoconstriction gives but a few hours relief at the most

The narcotic group of drugs has provided the age old therapy for pain These agents even the recently developed ones have potent depressant side effects on ventilation and circulation The possible exception to this is codeine which tends to stimulate the central nervous system rather than depress it

Codeine phosphate should be an important drug for pain relief in the geriatric patient, however it has been passed by because of its allegedly weak anesthetic action *It is less depressant to both circulation and* ventilation and its analgesic effect gives a large majority of the older patients adequate pain relief Patients with depressed liver function should be given codeine for pain relief rather than morphine or meperidine which use the liver as a site of detoxification

Meperidine morphine and similar agents are in greatest vogue in spite of their depressing effects on circulation It is frequently alarming to see what profound circulatory depression even doses of 25 mg of meperidine will induce in postanesthetic patients in this age group It is important that one never make the dosage of postoperative analgesic a routine thing The dosage must be carefully individualized and the patient watched carefully in the recovery room and eventually in his own room for the side effects of the analgesic medication on both circulation and respiration It is far better to begin with 15 mg of meperidine in these geriatric patients and over a period of time titrate the amount of the drug for amelioration of pain than to give any large fixed dose The narcotic medication may produce such a profound circulatory depression that it will begin a chain of circulatory instability that ends in death in the early postoperative phase

The postoperative patient should be helped with his pain However it never should be entirely abolished It can be made bearable and a little stimulation keeps the patient active and moving in the postoperative phase It is disturbing to see a patient who has been carried astutely through a surgical procedure on minimal anesthetic agents arrive in the recovery room and receive a dose of narcotic which puts him into profound circulatory and central nervous system depression after his compensatory mechanisms were maintained intact throughout the surgical procedure itself

Certain tranquilizing drugs of the phenothiazine group are in vogue today They may markedly potentiate the sedative and depressant properties of analgesic drugs Tranquilizers may have already been given to these patients for control of the emotional state or the hypertension which is so common in this age group However the tranquilizers often have multiple pharmacologic effects and when opiates are added indiscriminately there may be marked cardiovascular depression Narcotics should be used cautiously in reduced dosage in patients known to be receiving tranquilizers until the total effect can be assessed

Ventilation

It is most important that adequate ventilation be maintained in the early postanesthetic period This requires careful attention by recovery room personnel and by those physicians entrusted with the immediate postoperative care of the patient

Frequently a patient arrives in the recovery area responding to stimuli with an apparently good airway It is not uncommon however to find that he has become stuporous rather than more alert Under these circumstances the edentulous patient develops respiratory obstruction Geriatric patients with weak musculature may be unable to clear their airways and upper respiratory obstruction occurs Even patients who have previously been reacting on an oropharyngeal airway may become somnolent again after the airway has been removed and respiratory obstruction ensues Even short bouts of asphyxia may be sufficient in these patients to produce death

A simple means of determining air obstruction is the observation of the movements of the chest wall or diaphragm

Obstruction need not be heralded by noisy snoring or stertorous respiration it frequently is silent and unobtrusive but deadly If the patient has a completely patent airway the chest wall rises as the diaphragm descends making a smooth coordinated act Obstruction changes the time of respiration as the chest wall will lag behind or retract in association with an unusually forceful diaphragmatic descent Positioning of the head or reinsertion of an airway of suitable size clears the airway immediately

Inadequate ventilation may not be related to airway obstruction but to many other causes Preexisting pulmonary disease may be present causing changes in compliance of the lung and chest wall which result in decreased pulmonary capillary diffusion These deficits may be aggravated by con

tinual depression of the respiratory center by the general anesthetic or persistent action at the neuromuscular junction by the muscle relaxant drug

If the inadequate ventilation is due to central respiratory depression resulting from the general anesthetic it should be remedied by increasing the oxygen concentration in the inspired mixture by a suitable oxygen mask or oropharyngeal oxygen catheter and respiration should be assisted by an inspiratory positive pressure assisting device or a cycling pressure suit of the Emerson type High concentrations of carbon dioxide given by inhalation are to be condemned in this period of recovery for usually the carbon dioxide is already high and further increases can only be detrimental The same therapy should be used if the ventilatory inadequacy is due to persistent muscle relaxant action provided that pharmacologic therapy has been given to antagonize those relaxants which are capable of reversal

POSTOPERATIVE COMPLICATIONS WHICH MAY BE RELATED TO ANESTHESIA

Atelectasis

Atelectasis without pneumonia is usually found during the first or second postoperative day and may be related to several causes Most frequently it is a disk type of atelectasis of the lower lobes related to breaking the air seal between the liver and the diaphragm or due to the pressure from retractors held under the diaphragm for a long time Mucous plugs in bronchi are a cause of atelectasis of a segment an entire lobe or an entire lung This degree of atelectasis usually produces symptoms and needs early adequate therapy

It is most important that one recognize an atelectatic area early and encourage the patient to cough if this maneuver does not clear the atelectatic area it is important to use nasotracheal suction of the tracheobronchial tree in an attempt to remove the secretions This can easily be done with the patient in the sitting position and a No 16 catheter placed into the trachea by a blind technique during inspiration Inhalation of detergent aerosols may liquefy tracheobronchial secretions and allow them to be coughed up more easily If this does not clear the atelectasis then direct bronchoscopic suction should be performed

Atelectasis in this age group should not be treated by watchful waiting Many times direct bronchoscopic suction is withheld because it is felt that this is traumatic and only a last resort Bronchoscopy should be done early in the course of the complication just as soon as the supposedly more conservative measures have failed

If one temporizes with atelectasis in this age group one may set in motion an irreversible process which ends in an asphyxial death It is indeed dramatic to see the response that the patients make when the atelectatic area is reexpanded

Pneumonia

Both lobar and bronchopneumonia are seen The former usually results from infection in an atelectatic area of the lung while the latter is secondary to aspiration of already infected salivary secretion gastric secretion or blood Aspiration occurs more easily in the geriatric patient owing to his inability to cough well and his diminished tracheobronchial ciliary activity This pneumonia is a widespread patchy lesion

Although the over all complication rate related to anesthesia is below 1 per cent postoperative pneumonia accounts for more than 50 per cent of this group There appears to be a lower incidence of pneumonia in patients anesthetized by the endotracheal technique This lower incidence is most likely related to protection from aspiration and ease of adequate toilet of the tracheobronchial tree throughout and at the end of the operative procedure

Immobility on the operating table for long periods invites pneumonia as blood will be static in posterior portions of the lung pro-

Meperidine morphine and similar agents are in greatest vogue in spite of their depressing effects on circulation It is frequently alarming to see what profound circulatory depression even doses of 25 mg of meperidine will induce in postanesthetic patients in this age group It is important that one never make the dosage of postoperative analgesic a routine thing The dosage must be carefully individualized and the patient watched carefully in the recovery room and eventually in his own room for the side effects of the analgesic medication on both circulation and respiration It is far better to begin with 15 mg of meperidine in these geriatric patients and over a period of time titrate the amount of the drug for amelioration of pain than to give any large fixed dose The narcotic medication may produce such a profound circulatory depression that it will begin a chain of circulatory instability that ends in death in the early postoperative phase

The postoperative patient should be helped with his pain However it never should be entirely abolished It can be made bearable and a little stimulation keeps the patient active and moving in the postoperative phase It is disturbing to see a patient who has been carried astutely through a surgical procedure on minimal anesthetic agents arrive in the recovery room and receive a dose of narcotic which puts him into profound circulatory and central nervous system depression after his compensatory mechanisms were maintained intact throughout the surgical procedure itself

Certain tranquilizing drugs of the phenothiazine group are in vogue today They may markedly potentiate the sedative and depressant properties of analgesic drugs Tranquilizers may have already been given to these patients for control of the emotional state or the hypertension which is so common in this age group However the tranquilizers often have multiple pharmacologic effects and when opiates are added indiscriminately there may be marked cardiovascular depression Narcotics should be used cautiously in reduced dosage in patients known to be receiving tranquilizers until the total effect can be assessed

Ventilation

It is most important that adequate ventilation be maintained in the early postanesthetic period This requires careful attention by recovery room personnel and by those physicians entrusted with the immediate postoperative care of the patient

Frequently a patient arrives in the recovery area responding to stimuli with an apparently good airway It is not uncommon however to find that he has become stuporous rather than more alert Under these circumstances the edentulous patient develops respiratory obstruction Geriatric patients with weak musculature may be unable to clear their airways and upper respiratory obstruction occurs Even patients who have previously been reacting on an oropharyngeal airway may become somnolent again after the airway has been removed and respiratory obstruction ensues Even short bouts of asphyxia may be sufficient in these patients to produce death

A simple means of determining air obstruction is the observation of the movements of the chest wall or diaphragm

Obstruction need not be heralded by noisy snoring or stertorous respiration it frequently is silent and unobtrusive but deadly If the patient has a completely patent airway the chest wall rises as the diaphragm descends making a smooth coordinated act Obstruction changes the time of respiration as the chest wall will lag behind or retract in association with an unusually forceful diaphragmatic descent Positioning of the head or reinsertion of an airway of suitable size clears the airway immediately

Inadequate ventilation may not be related to airway obstruction but to many other causes Preexisting pulmonary disease may be present causing changes in compliance of the lung and chest wall which result in decreased pulmonary capillary diffusion These deficits may be aggravated by con

tinual depression of the respiratory center by the general anesthetic or persistent action at the neuromuscular junction by the muscle relaxant drug

If the inadequate ventilation is due to central respiratory depression resulting from the general anesthetic it should be remedied by increasing the oxygen concentration in the inspired mixture by a suitable oxygen mask or oropharyngeal oxygen catheter and respiration should be assisted by an inspiratory positive pressure assisting device or a cycling pressure suit of the Emerson type. High concentrations of carbon dioxide given by inhalation are to be condemned in this period of recovery for usually the carbon dioxide is already high and further increases can only be detrimental. The same therapy should be used if the ventilatory inadequacy is due to persistent muscle relaxant action provided that pharmacologic therapy has been given to antagonize those relaxants which are capable of reversal

POSTOPERATIVE COMPLICATIONS WHICH MAY BE RELATED TO ANESTHESIA

Atelectasis

Atelectasis without pneumonia is usually found during the first or second postoperative day and may be related to several causes. Most frequently it is a disk type of atelectasis of the lower lobes related to breaking the air seal between the liver and the diaphragm or due to the pressure from retractors held under the diaphragm for a long time. Mucous plugs in bronchi are a cause of atelectasis of a segment, an entire lobe or an entire lung. This degree of atelectasis usually produces symptoms and needs early adequate therapy

It is most important that one recognize an atelectatic area early and encourage the patient to cough; if this maneuver does not clear the atelectatic area it is important to use nasotracheal suction of the tracheobronchial tree in an attempt to remove the secretions. This can easily be done with the patient in the sitting position and a No 16 catheter placed into the trachea by a blind technique during inspiration. Inhalation of detergent aerosols may liquefy tracheobronchial secretions and allow them to be coughed up more easily. If this does not clear the atelectasis then direct bronchoscopic suction should be performed

Atelectasis in this age group should not be treated by watchful waiting. Many times direct bronchoscopic suction is withheld because it is felt that this is traumatic and only a last resort. Bronchoscopy should be done early in the course of the complication just as soon as the supposedly more conservative measures have failed

If one temporizes with atelectasis in this age group one may set in motion an irreversible process which ends in an asphyxial death. It is indeed dramatic to see the response that the patients make when the atelectatic area is reexpanded

Pneumonia

Both lobar and bronchopneumonia are seen. The former usually results from infection in an atelectatic area of the lung while the latter is secondary to aspiration of already infected salivary secretion, gastric secretion or blood. Aspiration occurs more easily in the geriatric patient owing to his inability to cough well and his diminished tracheobronchial ciliary activity. This pneumonia is a widespread patchy lesion

Although the over all complication rate related to anesthesia is below 1 per cent postoperative pneumonia accounts for more than 50 per cent of this group. There appears to be a lower incidence of pneumonia in patients anesthetized by the endotracheal technique. This lower incidence is most likely related to protection from aspiration and ease of adequate toilet of the tracheobronchial tree throughout and at the end of the operative procedure

Immobility on the operating table for long periods invites pneumonia as blood will be static in posterior portions of the lung pro-

ducing a red hepatization Infection follows in these areas, and pneumonia is produced

Laryngeal Edema

The author does not believe that the geriatric patient has any increased incidence of laryngeal edema over his young counterpart However, if he does develop edema of the larynx he usually has a poorer respiratory compensatory mechanism and small bouts of asphyxia may mean sudden death Therefore it is important particularly in this age group that one resort early to tracheostomy and that one perform it as an elective procedure rather than temporizing until an emergency procedure becomes necessary If one is at all concerned about the airway the patient should be placed in an area of high humidity or steam as frequently this therapy also will reduce minimal edema

Peripheral Nerve Injury

One always must show great care in positioning a patient on the operating table lest plexuses be stretched or nerves compressed The author thinks that it is most important in this age group to be extremely careful that the shoulders elbows and lower extremities do not press on any metal parts of the operating table Frequently these patients are quite thin without a great deal of subcutaneous fat and thus pressure on nerves is more likely to produce damage One should pad the arms well and make sure that the patient s feet are not off the edge of the table

Pressure sensitive Areas

The skin of these patients is often thin and poorly supplied with blood Where bony prominences press through the skin for a long time ischemia and pressure sores may result Elbows sacrum and heels should be adequately positioned and padded to prevent skin trauma by underlying superficial bones Anesthetic masks should not be strapped to the face for long periods

The geriatric patient frequently calls on all the resourcefulness of the anesthesiologist as several organ systems may be failing simultaneously Only if one corrects minor problems immediately can one prevent major problems, which later may be difficult impossible to correct

BIBLIOGRAPHY

Adriani J and Campbell D The Absorption of Topically Applied Tetracaine and Cocaine Laryngoscope 68 65 1958

Artusio J F Jr Diethyl Ether Analgesia A Detailed Description of the First Stage of Ether Anesthesia in Man J Pharmacol & Exper Therap 111 343 1954

Artusio J F Jr Ether Analgesia during Major Surgery J A M A 157 33 1955

Artusio J F Jr Marbury B E and Crews M A A Quantitative Study of D tubocurarine Tri (diethylaminoethoxy) 1 2 3 Benzene (Flaxedil) and a Series of Tri methyl and Dimethylethylammonium Compounds in Anesthetized Man Ann New York Acad Sc 54 512 1951

Beecher H F Francis L and Anfinsen C B Metabolic Effects of Anesthesia in Man I Acid Base Balance during Ether Anesthesia J Pharmacol & Exper Therap 98 38 1950

Brewster W R Jr Isaacs J P and Waino-Anderson T Depressant Effect of Ether on Myocardium of the Dog and Its Modification by Reflex Release of Epi and Nor nephrine Am J Physiol 175 399 1953

Bunker J P Beecher H K Brizzo B Brewster W R and Barnes B A Metabolic Effects of Anesthesia II A Comparison of Acid Base Equilibrium in Man and in Dogs during Ether and during Cyclopropane Anesthesia J Pharmacol & Exper Therap 102 62 1951

Burnett C H Bloomberg E L Shotz G Compton D W and Beecher H K A Comparison of the Effects of Ether and Cyclopropane Anesthesia on Renal Function of Man J Pharmacol & Exper Therap 96 380 1949

Coakley C S Alpert S and Boling J Circulatory Responses during Anesthesia of Patients on Rauwolfia Therapy J A M A 161 1143 1956

Dripps R D The Immediate Decrease in Blood Pressure Seen at the Conclusion of

Cyclopropane Anesthesia Anesthesiology 8: 15 1947

Dripps R D and Comroe J H Circulatory Physiology The Readjustment of Blood Loss and Postural Changes S Clin North America 26:1368 1946

Dripps R D and Severinghaus J W General Anesthesia and Respiration Physiol Rev 34:741 1955

Eckenhoff J E and Helrich M The Study of Narcotics and Sedatives for Use in Preanesthetic Medication J A M A 167:415 1958

Fairlie C W Barss T P French A B Jones C M and Beecher H K Metabolic Effects of Anesthesia in Man IV A Comparison of the Effects of Certain Anesthetic Agents on the Normal Liver New England J Med 244:615 1951

French A B Barss T P Fairlie C S Bengle A L Jr Jones C M Linton R R and Beecher H K Metabolic Effects of Anesthesia in Man V A Comparison of the Effects of Ether and Cyclopropane Anesthesia on the Abnormal Liver Ann Surg 135:145 1952

Habif D V Papper E M Fitzpatrick H F Lawrence P Smythe C M and Bradley S E The Renal and Hepatic Blood Flow Glomerular Filtration Rate and Urinary Output of Electrolytes during Cyclopropane Ether and Thiopental Anesthesia Operations and the Immediate Post-operative Period Surgery 10:241 1951

Hershey S G Zweifach B W and Rovenstine E A Effects of Depth of Anesthesia on Behavior of Peripheral Vascular Bed Anesthesiology 14:245 1953

Orkin L Siegel M and Rovenstine E Resistance to Breathing by Apparatus Used in Anesthesia 1 Endotracheal Equipment Anesth & Anal 33:217 1954

Orkin L Siegel M and Rovenstine E Resistance to Breathing by Apparatus Used in Anesthesia 2 Valves and Machines Anesth & Anal 36:19 1957

Salassa R M et al Post-operative Adrenal Cortical Insufficiency Occurrence in Patients Previously Treated with Cortisone J A M A 152:1509 1953

Saklad M Rating of Patients for Surgical Procedures Anesthesiology 2:28 1941

Steinhaus J E Local Anesthetic Toxicity Anesthesiology 18:275 1957

Vandam L D and Dripps R D Long-term Follow-up of Patients Who Received 10,098 Spinal Anesthetics J A M A 161:586 1956

5

Postoperative Care and Management

Eugene E Clifton

In the postoperative management of the geriatric patient the prevention rather than the treatment of complications should be stressed It is generally conceded that the aged patient will respond well to a properly administered anesthesia and a properly performed operation if complications are not already present or do not develop in the early postoperative course However the margins of reserve and consequently of safety are so slim in many of these patients that the area for maneuvering in treatment of a complication may be hazardously narrowed This is true since degenerative changes have usually occurred in organ systems other than the one affected by the surgical disease under treatment particularly the cardiovascular cerebral renal and hepatic The complication itself may be very simple to treat but it may throw stress on another weakened system which then collapses under the added strain

The postoperative care of the geriatric patient must begin with his first visit to the surgeon or his consultants A thorough history and physical examination before treatment should indicate areas in which postoperative difficulties may be expected and in which special care will be necessary These usually are the cardiovascular pulmonary and urinary systems Complete records of previous medical management and particularly of idiosyncrasy to diet drugs and treatments are essential Prior x ray and laboratory studies particularly chest films and ECG will lead to an understanding not only of the present condition of the patient but of the rate of development of present disabilities The former record will indicate organs which have been diseased and which may have developed sequelae that are not apparent under normal conditions but might become serious under stress

With this group of patients in particular it is essential to establish confidence and a relaxed peaceful state of mind by assurance rather than by the use of drugs which in themselves may produce or add to serious complications Before operation the patient must be brought to the best state of function possible commensurate with the need for haste in emergency or urgent surgical conditions He should be instructed and trained in the postoperative treatments to be used such as deep breathing and expiration exercises and exercises of the extremities During this same period it is necessary to reassure these patients that they will be returned to a useful satisfying life Necessary procedures must be explained thoroughly perhaps repeatedly in order to obtain adequate cooperation

Time should also be taken in the preoperative period to replace deficits in blood volume protein and electrolytes Not only will this enable the patient to withstand the immediate ravages of anesthesia and surgery more satisfactorily but it will make the postoperative care much simpler

It is obvious that the postoperative management of the aged patient is fundamentally the same as that in any age group with special care in certain departments It is also

clear that the complications to be expected and their management will vary with the area operated upon and the diseased or subnormal organ systems.

IMMEDIATE POSTOPERATIVE CARE

In the immediate postoperative period the aged patient must be observed even more carefully than the average patient. Abnormalities in response, especially of the cardiovascular system and of pulmonary and renal function, must be immediately compensated. Observations of pulse, respiration, blood pressure, and urinary output, as well as general responsiveness and the condition of the wound, must be carefully observed.

Immediately postoperatively, easily absorbed gases must be washed out and a careful tracheobronchial toilet performed. This militates against the production of bronchial plugs which cannot be coughed up and prevents the reabsorption of highly diffusible gas behind a plug, thus leaving an atelectatic area which would most certainly cause trouble. If the operation was an abdominal or pelvic procedure of any significance, a gastric tube should be left in place; this should be on suction or at least should be thoroughly aspirated and left open on dependent drainage. Until he has reacted the patient should have the head dependent or at least be on his side or abdomen to prevent aspiration even if a gastric tube is in place.

If a thoracic surgical procedure has been performed and tubes are left in the pleural cavity, they should be placed on underwater seal from the time of closure of the chest. This prevents a build-up of pneumothorax and the development of subcutaneous emphysema, especially if the patient should cough or retch before the final attachment of the suction apparatus. It is wise always to maintain an underwater seal with as little tubing as possible, regardless of the type of suction apparatus used, to prevent the serious accident of the chest cavity being opened to atmospheric pressure through the tube. In the poor-risk patient with significant cardiopulmonary dysfunction this is of particularly vital importance.

Control of the pain is usually not as much of a problem in the elderly as in the younger age groups. This is fortunate, since these patients tolerate narcotics poorly. Opium derivatives, including morphine, should be used sparingly in one third to one half normal dosage, if at all, for very specific indications. The central respiratory inhibition and depression of cough reflex is particularly harmful in these patients. Demerol in doses of 25 to 50 mg is usually quite satisfactory, as are other synthetic narcotics, such as Levo-Dromoran, in small doses.

The management of shock or even of routine fluid replacement can be a trying experience in the poor-risk older patient. It may be a truism to say that it is essential to establish the causal mechanism of the shock in these individuals, but this is necessary for proper management. Shock must be treated quickly and vigorously. Since 90 per cent of older patients have arteriosclerosis, even though it may be symptomless under normal conditions, it must be expected that differential constriction will be less efficient and the redistribution of blood to vital organs will be limited in its effectiveness. Shock or even a sudden fall in blood pressure may precipitate a coronary occlusion, particularly in patients afflicted with angina or coronary insufficiency. Pulmonary or cerebrovascular occlusion may follow a sudden drop in blood pressure. It is well recognized that shock states may produce an acute liver damage even in normal adults. With previous liver involvement and loss of reserve, particularly with cirrhosis, this occurs much more easily and irreversible shock or death may supervene. The loss of blood flow to previously damaged kidneys may cause anuria, oliguria, or at least further damage and always results in an increase in the azotemia universally seen in hemorrhage. The use of an indwelling catheter for hour-by-hour control of fluid replacement is very desirable and may be life saving. It is well to remember, however, that if the kidneys are severely dam-

5

Postoperative Care and Management

Eugene E. Clifton

In the postoperative management of the geriatric patient the prevention rather than the treatment of complications should be stressed. It is generally conceded that the aged patient will respond well to a properly administered anesthesia and a properly performed operation if complications are not already present or do not develop in the early postoperative course. However the margins of reserve and consequently of safety are so slim in many of these patients that the area for maneuvering in treatment of a complication may be hazardously narrowed. This is true since degenerative changes have usually occurred in organ systems other than the one affected by the surgical disease under treatment particularly the cardiovascular cerebral renal and hepatic. The complication itself may be very simple to treat but it may throw stress on another weakened system which then collapses under the added strain.

The postoperative care of the geriatric patient must begin with his first visit to the surgeon or his consultants. A thorough history and physical examination before treatment should indicate areas in which postoperative difficulties may be expected and in which special care will be necessary. These usually are the cardiovascular pulmonary and urinary systems. Complete records of previous medical management and particularly of idiosyncrasy to diet drugs and treatments are essential. Prior x ray and laboratory studies particularly chest films and ECG will lead to an understanding not only of the present condition of the patient but of the rate of development of present disabilities. The former record will indicate organs which have been diseased and which may have developed sequelae that are not apparent under normal conditions but might become serious under stress.

With this group of patients in particular it is essential to establish confidence and a relaxed peaceful state of mind by assurance rather than by the use of drugs which in themselves may produce or add to serious complications. Before operation the patient must be brought to the best state of function possible commensurate with the need for haste in emergency or urgent surgical conditions. He should be instructed and trained in the postoperative treatments to be used such as deep breathing and expiration exercises and exercises of the extremities. During this same period, it is necessary to reassure these patients that they will be returned to a useful satisfying life. Necessary procedures must be explained thoroughly perhaps repeatedly in order to obtain adequate cooperation.

Time should also be taken in the preoperative period to replace deficits in blood volume protein and electrolytes. Not only will this enable the patient to withstand the immediate ravages of anesthesia and surgery more satisfactorily but it will make the postoperative care much simpler.

It is obvious that the postoperative management of the aged patient is fundamentally the same as that in any age group, with special care in certain departments. It is also

clear that the complications to be expected and their management will vary with the area operated upon and the diseased or subnormal organ systems

IMMEDIATE POSTOPERATIVE CARE

In the immediate postoperative period the aged patient must be observed even more carefully than the average patient Abnormalities in response especially of the cardiovascular system and of pulmonary and renal function must be immediately compensated Observations of pulse respiration blood pressure and urinary output as well as general responsiveness and the condition of the wound must be carefully observed

Immediately postoperatively easily absorbed gases must be washed out and a careful tracheobronchial toilet performed This militates against the production of bronchial plugs which cannot be coughed up and prevents the resorption of highly diffusible gas behind a plug thus leaving an atelectatic area which would most certainly cause trouble If the operation was an abdominal or pelvic procedure of any significance a gastric tube should be left in place this should be on suction or at least should be thoroughly aspirated and left open on dependent drainage Until he has reacted the patient should have the head dependent or at least be on his side or abdomen to prevent aspiration even if a gastric tube is in place

If a thoracic surgical procedure has been performed and tubes are left in the pleural cavity they should be placed on underwater seal from the time of closure of the chest This prevents a build up of pneumothorax and the development of subcutaneous emphysema especially if the patient should cough or retch before the final attachment of the suction apparatus It is wise always to maintain an underwater seal with as little tubing as possible regardless of the type of suction apparatus used to prevent the serious accident of the chest cavity being opened to atmospheric pressure through the tube In the poor risk patient with significant cardiopulmonary dysfunction this is of particularly vital importance

Control of the pain is usually not as much of a problem in the elderly as in the younger age groups This is fortunate since these patients tolerate narcotics poorly Opium derivatives including morphine should be used sparingly in one third to one half normal dosage if at all for very specific indications The central respiratory inhibition and depression of cough reflex is particularly harmful in these patients Demerol in doses of 25 to 50 mg is usually quite satisfactory as are other synthetic narcotics such as Levo Dromoran in small doses

The management of shock or even of routine fluid replacement can be a trying experience in the poor risk older patient It may be a truism to say that it is essential to establish the causal mechanism of the shock in these individuals but this is necessary for proper management Shock must be treated quickly and vigorously Since 90 per cent of older patients have arteriosclerosis even though it may be symptomless under normal conditions it must be expected that differential constriction will be less efficient and the redistribution of blood to vital organs will be limited in its effectiveness Shock or even a sudden fall in blood pressure may precipitate a coronary occlusion particularly in patients afflicted with angina or coronary insufficiency Pulmonary or cerebrovascular occlusion may follow a sudden drop in blood pressure It is well recognized that shock states may produce an acute liver damage even in normal adults With previous liver involvement and loss of reserve particularly with cirrhosis this occurs much more easily and irreversible shock or death may supervene The loss of blood flow to previously damaged kidneys may cause anuria oliguria or at least further damage and always results in an increase in the azotemia universally seen in hemorrhage The use of an indwelling catheter for hour by hour control of fluid replacement is very desirable and may be life saving It is well to remember however that if the kidneys are severely dam

aged urinary flow rate and specific gravity cannot be depended upon to indicate whether dehydration adequate hydration or over hydration is present This can be determined only by electrolyte blood volume, and blood chemistry determinations

If loss of blood is the cause of shock it must be replaced without delay Shock due to adrenal insufficiency must be countered by intravenous cortisone in adequate dosage with the understanding that once started, this therapy will be maintained throughout the postoperative course until the patient is stabilized well enough to permit its gradual withdrawal aided by adrenocorticotropic hormone Although they are not universally accepted as a form of therapy in the aged the author feels that in serious shock vasopressor drugs should be used in adequate dosage to maintain a blood pressure sufficient to continue good filtration pressure in the kidneys and adequate coronary and cerebral circulation This must be continuously regulated to prevent hypertension Norepinephrine (Levophed) or methoxamine (Vasoxyl) seem to be the most satisfactory of these agents

Fluid and electrolyte therapy in these conditions is generally difficult to manage especially if proper base line balance was not obtained before operation The shock itself may be due to electrolyte imbalance particularly hyponatremia yet the use of saline may only produce pulmonary edema or increase the dangers of decompensation In general fluids should be limited to glucose in water at least in the first 24 hours and the quantity ordinarily should not exceed 2 000 cc unless quantities of fluids or electrolytes are being lost from the gastrointestinal tract

When intravenous fluids must be used in a patient with incipient decompensation the value of a manometer introduced into the infusion system with a three way stopcock cannot be overestimated This permits adjustment of the rate of transfusion or infusion to give adequate venous return to the heart while avoiding congestion of the pulmonary vessels

The occurrence of cardiac arrest in these individuals is obviously even more serious than it is in a younger patient since the heart is probably already damaged With previous heart block the cause is usually ventricular standstill Rhythm may be reinstituted by Adrenalin but this drug is contraindicated in those arrests based on fibrillation Positive pressure with a respirator and endotracheal tube is indicated and thoracotomy with cardiac massage should be instituted if circulation is not immediately reestablished An automatic pacemaker may be lifesaving in those hearts which already have severe conduction deficits

With any cardiopulmonary dysfunction oxygen therapy should be used in the immediate postoperative period particularly if there is any shock or sign of cyanosis Such therapy may be very helpful with poor cardiac function even when there is little or no dyspnea Functional survival of heart brain liver and other vital organs may depend on the increased oxygenation supplied by this means In general intermittent oxygen therapy or oxygen by respirator is preferable to other methods in order to prevent or assuage the complication of carbon dioxide narcosis due to carbon dioxide retention especially in patients with emphysema or pulmonary fibrosis Where these are not available or do not seem essential a nasal catheter or a mask is usually preferable to a tent since a higher concentration of oxygen can be obtained

GENERAL POSTOPERATIVE CARE

Once the acute effects of surgery and anesthesia are overcome the general care of the patient must be patterned to prevent further complications Although in many cases the shock of the operative procedure superimposed on a seriously weakened body may limit activity seriously active mobilization must be instituted as soon as the elderly pa

tient is fully responsive even if this means only deep breathing complete exhalation and moving the hands and feet The patient should be turned from side to side at least at hourly intervals and he should actively aid in this movement

As rapidly as consistent with the patient s strength he should develop a routine of complete mobilization of arms and legs and deep respirations at hourly intervals Exercises to maintain the strength of abdominal and gluteal muscles and extensors of the knee and spine should be started early Sitting up with the legs over the side of the bed should be next in order then standing beside the bed and finally walking The pernicious practice of getting the patient into a chair by any means possible permitting him to sit there for a period of time and calling this ambulation should be condemned Flexion of the knees and thighs with slowing of circulation pressure on the veins and pooling in the lower legs can only increase rather than prevent thrombosis and this position certainly does not improve respiration and gastrointestinal function

Early mobilization aids in the general rehabilitation of the patient and is particularly important in the older person since it reassures him that he is not to become bed ridden and helpless a condition that so many fear It also aids in return of urinary and gastrointestinal function and particularly in pulmonary rehabilitation It is well to remember however that it should not be pushed beyond tolerance in those with significant pulmonary (emphysema and fibrosis) or cardiovascular deficiency since over exertion may produce a decompensation of these functions Falls causing serious injuries particularly hip fractures are not uncommon if early mobilization is not carefully supervised in weak unsure patients

RESPIRATORY SYSTEM

Since pulmonary complications especially pneumonia are the most common cause of postoperative death in these patients their prevention and management are of the greatest importance The patients should be observed and examined frequently Difficulty in raising thick tenacious sputum should be countered by general measures such as coughing which is usually more effective in late expiration than after a deep inspiration the use of inhalations such as wetting agents (Alevaire) and even more effective pancreatic dornase inhalations two to three times a day If atelectasis develops as indicated by rapid development of dyspnea with low to moderate fever and physical signs of partial collapse or poorly aerated lung with or without coarse rales and rhonchi more active therapy is indicated One should never wait for x ray evidence of atelectasis which may be wanting until the area is large or associated with pneumonitis These patients with poor function to begin with will not tolerate large atelectases Pancreatic dornase frequently is effective in relieving atelectases due to mucous plugs If not successful endotracheal aspirations should be done and if dysfunction is severe enough and these treatments unsuccessful bronchial aspiration through a bronchoscope should not be delayed For less severe cases of tenacious mucus potassium iodide by mouth (60 to 300 mg) every 4 hours or ammonium chloride (1 to 2 Gm) every 4 hours may be effective after a few days Inhalations of carbon dioxide (10 per cent) and oxygen (90 per cent) every 2 to 4 hours may be helpful in loosening secretions If pneumonia develops a specific antibiotic or a broad spectrum antibiotic should be given in large doses until the infection is controlled but no longer

With dysfunction due to emphysema and fibrosis complicated by asthmatic bronchitis or so-called bronchospasm bronchodilator therapy may be necessary Ephedrine sulfate (25 mg) three to four times per day Orthoxine (100 mg) four times per day or aminophylline may be used Aerosols of Vaponefrin or Isuprel are very helpful in clearing the lungs under these circumstances Pos

itive pressure oxygen has been suggested but one must beware of overdistending an already emphysematous lung with further loss of function especially in patients who have had pulmonary resections Adrenal steroid therapy may be necessary in intract able cases

If oxygen therapy is necessary it should be approached with great care to prevent *carbon dioxide retention and narcosis* With respiratory acidosis and carbon dioxide re *tention if respirations are not forced to wash* out carbon dioxide the build up may be so high as to paralyze the *respiratory center* Oxygen should be delivered intermittently if possible by a nasal catheter or mask if it must be given continuously The level of delivery should be gradually increased and the patient should be observed for hypoven tilation The pH and carbon dioxide levels of the blood should be obtained If hypoventila tion persists one of the mechanical respira tors or manual bag ventilation should be used to assure adequate exchange and washing out of carbon dioxide Diamox (250 mg twice a day) may be helpful since it accel erates *elimination of carbon dioxide via the* kidneys

*If emphysema persists as a disabling fac*tor preventing the patient s return to an active life diaphragmatic and breathing exer cises should be stressed with concentration on the expiration phase which is least sat isfactory because of the loss of pulmonary elastic recoil Abdominal supports are also helpful with emphysema For long term treatment of patients with ineffective cough who accumulate much sputum a negative pressure exsufflator will be helpful in con junction with *the methods outlined above*

Although cough is usually desirable and *should not be hampered there are* some in stances where a dry hacking cough due to irritation or emphysema is a serious hazard leading to hernia formation or even dehis cence or evisceration of wounds In these cases codeine or synthetic codeine may be given for its cough inhibiting effects An even better antitussive agent *without appar*ent side effects is Tessalon, a drug which acts locally by inhibiting the stretch receptor reflex

CARDIOVASCULAR SYSTEM

Cardiovascular complications are prob ably the next most frequent and severe About 90 per cent of geriatric patients have atherosclerosis or other degenerative dis eases of this system The danger that shock *or sudden fall in blood pressure* may con tribute to thrombosis of coronary, cerebral *or peripheral vessels including those of the* mesentery and extremities has already been mentioned

In the presence of any other complica tions particularly pulmonary, or with hem orrhage, anemia electrolyte imbalance and excessive fluid administration an additional load is placed on the heart and serious re sults may be expected These include ar rythmias such as extrasystoles paroxysmal ventricular tachycardia fibrillation and de compensation

Paroxysmal ventricular tachycardia is not *in itself a serious indication but may lead to* more serious conditions since it places addi *tional stress on the circulation and* myocar dium Normal rhythm may return sponta neously with oxygen rest and sedation Procaine amide (Pronestyl), 0 5 to 1 Gm orally and then in smaller doses every 2 hours or similar doses intramuscularly at longer intervals every 3 to 4 hours should be given until normal rhythm is obtained If such measures are unsuccessful quinidine *should be tried with careful control by* ECG and blood pressure and under the direction *of a cardiologist* if available The oral route is preferable but intramuscular quinidine gluconate may be used (0 4 Gm every 2 hours) for six doses unless toxicity develops Hypotension is a contraindication The treat ment may be extended with great care till the irregularity is controlled or toxicity de velops

Congestive heart failure may follow rap*idly on surgery* or one of the complications

of surgery, particularly excessive fluid therapy If there is any indication of developing failure or uncontrolled arrhythmias the patient should be digitalized slowly if possible with digoxin or digitoxin If severe and acute more rapid digitalization with lanatoside C may be essential although dangerous If pulmonary edema develops the patient should be given morphine in not too large doses 8 to 10 mg and oxygen therapy under positive pressure Rotating tourniquets and/or phlebotomy of 500 to 800 cc may be necessary

With slower development of congestive failure the usual methods of treatment with salt restriction and diuretics should be instituted A trial dose of 0 5 cc of meralluride sodium (Mercuhydrin) may be given and this may be increased to 1 to 2 cc at biweekly intervals Acute renal disease is a contraindication to its use Aminophylline potentiates the effect of these diuretics and ammonium chloride 3 to 4 days prior to the injection will increase the excretion Oral diuretics will be found to be very useful for long term therapy These are acetazolamide (Diamox) a carbonic anhydrase inhibitor and chlorothiazide (Diuril) Acetazolamide has certain disadvantages such as the loss of bicarbonate This may lead to metabolic acidosis if not compensated but may be useful with carbon dioxide retention or alkalosis and the increased excretion of potassium with a possible increase in potassium deficit Chlorothiazide does not have these disadvantages Chlorothiazide has one additional effect potentiation of the hypotensive effect of drugs such as reserpine veratrum alkaloids hydralazine and ganglionic blocking agents The dosage of these drugs may and should be decreased when chlorothiazide (Diuril) is used This drug may permit the patient to take more salt thus aiding in postoperative nourishment since low salt diets are so unpalatable It is also useful in preventing accumulation of sodium and chloride in adrenal steroid and adrenocorticotropic hormone therapy Where there is severe retention of electrolytes ion exchange resins by mouth or by gastric or peritoneal lavage or, best of all a dialysis by an artificial kidney may be lifesaving

PERIPHERAL VASCULAR

Venous thrombosis either phlebothrombosis or thrombophlebitis is the most frequent peripheral vascular postoperative complication The effect of abnormalities in the clotting mechanism in producing these and arterial thromboses have not been elucidated The fact has been well established that stasis trauma to the vessels at surgery or by pressure on the operating table or postoperatively and infection are contributory Positioning which permits stasis or pressure on vessels must be prevented not only on the operating table but in the postoperative care Sitting in a chair for long periods of time must be considered bad positioning in the postoperative course

Properly applied elastic bandages or better yet light elastic stockings are very helpful in preventing venous thrombosis These should be used even when the patient is on bed rest Their constant pressure forces blood into the deep circulation thus preventing pooling There is little question that prophylactic control of clotting by the use of heparin and one of the Dicumarol derivatives will decrease the incidence of thrombosis This can be started very shortly after operation if proper care in hemostasis was taken at operation and if the clotting time or prothrombin time are carefully followed by an adequate laboratory One need not fear excessive bleeding Indeed some surgeons particularly in the Scandinavian countries have been carrying their poor risk patients through operation with moderate levels of dicumarolization without serious accident and with a much lower incidence of complications and mortality In poor risk patients with previous coronary occlusion cerebrovascular thromboses or repeated episodes of thrombophlebitis with or without pulmonary embolization this method of treatment seems justified Personal experience has confirmed

the opinion of those with large series of cases that this can be done safely with an apparent decrease in thrombotic complications Newer methods of therapy with fibrinolytic enzymes (plasmin streptokinase) may make this form of tightrope walking in prophylaxis unnecessary, since the thrombosis may be treated quickly with lysis of the clot

Thrombosis in the arterial system a less frequent and more serious complication can be controlled by the same means plus prevention of shock By slowing flow through narrowed diseased atherosclerotic vessels shock permits thrombosis or may even result in serious insufficiency to the degree of gangrene production without thrombosis

Embolization in the postoperative period most frequently follows shock states with sudden return of circulation or relief of fibrillation, just as in nonoperative conditions This can be minimized by adequate control of irregularities in rhythm of the heart before operation by digitalization and by prevention or rapid treatment of shock whatever its cause Control of excessive clotting by heparin or Dicumarol will not prevent the embolus but may minimize its serious impact by preventing clot propagation from the site of embolization

NUTRITION

Maintenance of nutrition in the postoperative patient can be a minor or a major problem depending on the preoperative state of nutrition the operative procedure performed and the development of complications in other systems The aged patient very frequently comes to the hospital in a poor state of nutrition Poor dietary habits lack of appetite shortage of funds and special diets for related medical diseases all predispose to this situation Malnutrition most frequently includes poor protein reserves vitamin deficiencies and electrolyte abnormalities These are usually not obvious since the patient has gradually adjusted to them over a long period of time They should be ferreted out by careful laboratory tests and compensated for gradually in the preoperative period rather than waiting until they become acute problems which can be managed with difficulty, if at all in the postoperative period

The patient with major gastrointestinal surgery poses the greatest problems in nutrition In the immediate, early and even sometimes into the late postoperative period nutrition by mouth, the most satisfactory means available, is impossible Low serum protein and tissue protein levels prolong postoperative recovery by producing edema with malfunction of the normal gastrointestinal tract and even more serious dysfunction in operative areas, frequently with obstruction at the anastomosis Electrolyte abnormalities, particularly low potassium levels also increase the gastrointestinal dysfunction Truly adequate nutrition cannot be maintained by parenteral means certainly not for a long period in spite of all recent advances Electrolyte therapy is no different for these people than for other age groups Potassium must be added in the postoperative period and sodium chloride must be limited especially in the early postoperative course Calories can be supplied by glucose if infused slowly, as it should be in these individuals under any circumstances to prevent pulmonary edema or decompensation Alcohol is also an excellent way of supplying calories and has additional advantages in being a fine sedative and acting as a vascular dilator of merit for elderly patients Invert sugar may be helpful in diabetics

Protein replacement is more difficult Protein hydrolysates help to maintain protein levels and to lessen the negative protein balance always seen postoperatively Amino acid solutions are even more useful but the best fail to replace proteins completely or to overcome the negative balance Plasma and albumin furnish excellent protein replacement as does whole blood but all carry the danger of serum hepatitis It must also be remembered that protein hydrolysates and albumin furnish a quantity of sodium chloride which is frequently contraindicated

The use of fat emulsions for maintenance of nutrition is still under investigation They are indicated in routine therapy only when other means of furnishing calories are completely inadequate Complications of fat emulsion infusion include severe back pain nausea vomiting and thrombosis Prolonged periods of infusion because of the essential slow rate should be broken from time to time to allow mobilization and to give a feeling of freedom to the patient

In elderly patients the return of gastrointestinal function is delayed in comparison with younger individuals just as are most other organ functions The gastric tubes should remain in place on suction until after bowel sounds are heard and it is wise to clamp the tube off for a few hours and even to give fluids through the tube and clamp it off for a time to determine that the stomach does not accumulate fluid and gas If marked distention occurs due to ileus or partial obstruction a rectal tube should be tried and if a colon anastomosis is not present enemas may be used If distention continues despite gastric and rectal tubes and heat to the abdomen, a long gastrointestinal tube (Miller Abbott Cantor or other) should be passed without delay Decompression should be continued until function returns as indicated by active bowel sounds and passage of gas or stool

It is well to remember that ileus may be due to or accentuated by protein deficiency or electrolyte abnormalities as well as the trauma of surgery and anesthesia Correction of these is of course essential Morphine and other narcotics may aggravate distention especially of the colon

The use of drugs such as neostigmine physostigmine and Pitressin to control ileus is not usually considered desirable because of their side effects especially in this age group They also are not usually necessary if adequate conservative measures are undertaken in time

As soon as intestinal function returns fluids by mouth with the exclusion of fruit juices because of their tendency to produce gas and distention should be started There should then be rapid advancement to a regular diet high protein in type if not contraindicated by specific conditions Since many elderly individuals have dietary idiosyncrasies of many years' duration it is far better to obtain normal food intake by whatever means possible than to insist on special hospital diets Many times the simple expedient of having special foods brought in by the family will stimulate faded appetite and make the difference between a patient s will and ability to recover and a gradual downhill course because of malnutrition and loss of interest Dietary supplements either high-protein alone (Proteinol) or more complete mixtures (Sustagen) should be given to increase nutrition

Achlorhydria is quite common in this age group (24 to 65 per cent) When present appetite and digestion especially absorption of calcium will be increased by dilute hydrochloric acid 10 cc in a glass of water taken through a straw

In some instances tube feeding may be necessary because of the patient s refusal to eat Pharyngeal irritation and esophagitis may be prevented by the use of a soft rubber or plastic tube a simple rubber sheath drain with a mercury pouch at the end to furnish weight to hold it in the stomach and a few small openings above the tie is excellent A short esophageal tube will also prevent esophagitis at the dangerous hiatus area though it will not prevent pharyngitis and possible tracheal aspiration

Protein retention and storage may be aided not only by diet but by altering the hormonal and enzymatic activity of the body Norethandrolone (Nilevar) acts to reverse the usual postoperative negative nitrogen balance and enhances protein anabolism Estrogen in the aged female and androgen in the male frequently improve the general welfare sufficiently to increase appetite and promote protein absorption Adrenal steroids in small doses may be very helpful in improving dietary intake and aiding in a general feeling of well being without the serious

side effects seen with larger therapeutic doses

Cathartics are a very personal matter with these older individuals and it is generally wise to use the patient s accustomed cathartic unless specifically contraindicated In general a mild cathartic such as milk of magnesia (30 cc) plus a lubricant (mineral oil 30 cc) is considered satisfactory for these patients Natural materials such as prunes figs or their juices are efficacious and well tolerated when they can be taken If bulk is lacking in the diet agar may be used Occasionally a stronger cathartic, such as compound licorice powder or cascara may be justified Enemas of the rectal flush type of saline soapsuds or glycerin may be justified to start peristalsis if a low colon anastomosis is not present In these older persons it is always necessary to carry out a rectal examination to rule out a fecal impaction if bowel function is abnormal The fact that an impaction cannot be felt does not rule it out however as it may be present higher frequently at the rectosigmoid junction Manual removal of low impaction may be possible and necessary Oil retention enemas will be useful for both low and high impactions although elderly patients may have difficulty retaining enemas because of sphincteric weakness

With the general use of antibiotic bowel preparations and postoperative antibiotics one must be more on guard against acute enterocolitis due particularly to *Micrococcus pyogenes* var *aureus* This complication which is very frequently fatal especially in the elderly patient may first be indicated by late unexplained distention before the onset of the severe dehydrating diarrhea Treatment must be started with the earliest symptoms and includes adequate fluid replacement sometimes in huge quantities blood transfusions discontinuance of the antibiotic responsible and perhaps specific antibiotics such as novobiocin Adrenal cortical steroids in adequate dosage may be very helpful just as they are in ulcerative colitis and other severe infections

URINARY TRACT

Urinary complications are also frequent particularly in the male and after pelvic or rectal operations in either sex Abdominoperineal resection is associated with a very high incidence (more than 50 per cent) of urinary dysfunction This again is a situation where preoperative care may prevent serious postoperative difficulties If prostatic hypertrophy is significant it may be wise to consider transurethral prostatectomy prior to major surgery In these patients one should at least limit possible difficulties by use of an indwelling catheter during operation and in the postoperative period until active mobilization and normal bladder tone can be expected to have returned

In the patient without significant urinary tract pathology the following routine is acceptable Spontaneous voiding may be awaited for 8 hours Patients who are unable to void while lying in bed may find it helpful to stand while water is running nearby Warm enemas especially with slightly irritating materials such as glycerin or soapsuds may stimulate urination Dripping ether on the suprapubic region is an old method sometimes successful When 8 hours have passed without voiding or if the bladder is obviously distended to physical examination catheterization under strict sterile precautions is indicated This should be repeated at 8 hour intervals if voiding does not return spontaneously after three or four catheterizations an indwelling catheter should be inserted and maintained until function returns or the urinary difficulty can be treated definitively If special equipment such as tidal drainage or intermittent irrigation equipment is necessary a urologist should be consulted At the time of first catheterization cultures should be obtained and then repeated as indicated If infection supervenes treatment should be by specific antibiotics indicated by culture Sulfisoxasole (Gantrisin) 3 to 4 Gm initially and then 1 to 2 Gm every 4 hours is an excellent urinary antiseptic Another very satisfactory

drug for urinary infections is nitrofurantoin (Furadantin), 5 to 10 mg per kg intravenously or by mouth every 6 hours

Failure to obtain normal urinary function because of bladder atony or dysfunction other than of an obstructive nature may be treated by parasympathetic stimulants such as neostigmine However this is considered undesirable in the aged and is absolutely contraindicated in asthmatics Mecholyl is contraindicated in this age group because of severe side effects especially central nervous system reactions and severe spasms

In patients with poor kidney function it is almost essential to use an indwelling catheter throughout the operation and the immediate and early postoperative periods If anuria or oliguria occurs it must be discovered at once Failure to urinate may be due either to mechanical factors or to kidney failure Kidney failure may follow upon shock transfusion, and allergic reactions It is especially likely to occur where kidney disease or urinary obstruction is already present a situation so very common in the geriatric patient

It is also wise to remember that in patients with poor kidney function even with an indwelling catheter one cannot depend on urinary output and concentration to determine the state of hydration With sufficiently poor renal function even in the presence of severe dehydration concentration can not occur Large quantities of urine put out in attempts to excrete metabolic products and to overcome acidosis may only lead to greater dehydration In contradistinction with renal shutdown partial or complete output may be minimal even in the presence of overhydration Under these circumstances one must depend on blood chemistry analyses especially urea nitrogen or nonprotein nitrogen levels pCO_2 and electrolytes Blood volume studies may also be useful but cannot be depended upon in the immediate postoperative period because of the formation of a third space

In these situations of rising azotemia with poor renal function postoperative care is complicated If the vascular and pulmonary systems are functioning well, it may be possible to push fluids to force excessive renal filtration and so to control the situation With cardiac failure of any degree this approach is limited Diuretics such as Mercuhydrin and ammonium chloride will increase diuresis over the long term Diamox may also be helpful especially with carbon dioxide retention

If urinary retention is severe the use of the artificial kidney or peritoneal lavage may be lifesaving Ordinarily these are useful only in situations where the patient may be carried over a crisis until his own excretory function eventually takes over with return to relatively normal conditions For electrolyte retention the use of ion exchange resins may be useful only in the patient whose gastrointestinal function is satisfactory although more recently gastric lavage with ion exchange resin has been used successfully

HEPATIC AND BILIARY SYSTEM

Abnormalities of liver function are particularly dangerous Although less common than cardiovascular pulmonary and renal defects they are when present more serious As high as 33⅓ per cent mortality can be expected with major abdominal surgery with significant cirrhosis of the liver The reasons for this are obvious Higher pressures in the arterial and portal systems are necessary for adequate hepatic nutrition With shock or marked fall in blood pressure the liver most commonly suffers additional damage to its parenchyma With blood transfusions absorption of blood or high protein diet ammonia intoxication may ensue This is characterized first by mental aberrations and hyperactivity and only later by sluggishness weakness and eventually coma Treatment of this abnormality consists of infusions of *monosodium glutamate* or arginine (R gene) Because of the excessive sodium the former may be contraindicated in this age group especially if there is cardiac decompensation or renal failure With

less serious liver dysfunction, one must strive to prevent damage by maintaining blood pressure and oxygenation at all times Blood loss must be immediately replaced and if dysfunction is not severe, a high protein high carbohydrate, high-vitamin intake will be necessary Choline was at one time felt to be particularly useful in liver disease and may still be used as a dietary supplement It should be remembered that with severe liver damage a high protein diet may precipitate ammonia intoxication

It is well recognized that vitamin K is essential in normal hemostasis, that it is synthesized by the liver, and that absorption of its precursor from the gastrointestinal tract is essential It may not be so well known that prolonged dietary restrictions and antibiotics which alter the intestinal flora may seriously inhibit the formation of vitamin K Synthetic vitamin K (Synkavite) should be given parenterally if there is a deficiency or if excessive bleeding occurs with liver and biliary disease It is also well to remember when using Dicumarol derivatives as anticoagulants in the postoperative course that liver damage and long term intestinal antibiotics enhance their effect Also liver damage from anesthesia and surgery becomes maximal after about four to seven days and it is at this time that sudden changes in the prothrombin time must be anticipated

GENERAL CARE

There are many difficulties which may be minor in the postoperative course of the young adult in good health but which in the aged poor risk patient may spell the difference between a rapid smooth convalescence and a prolonged miserable postoperative course with a tragic conclusion These include such simple things as care of the skin wounds and feet, especially toenails and general rehabilitation Other problems which are peculiar to the older patient and which frequently cause serious difficulties are singultus and parotitis

Care of the skin in the aged patient in itself is an art Too frequent bathing leads to drying of the skin, and alcohol rubs or ether preparations of the skin only increase this drying Less frequent bathing is necessary in these patients and oil should be added to their skin Pressure spots must be prevented at all costs by frequent movement doughnuts, sponge rubber pads, and if possible inflatable air mattresses If decubiti begin to develop they must be treated very actively by mobilization zinc oxide ointment or tincture of benzoin early and later ointments such as gentian violet scarlet red, allantoin or nitrofurazone Diet therapy with high protein diets and vitamins, particularly A and C is very helpful It should be remembered that in these conditions moist dressings and macerating ointments such as petroleum jelly are contraindicated

Care of the wound is of real importance in the older patient Healing may be slowed or incomplete because of poor nutrition particularly low proteins, vitamin deficiency especially vitamin C and deficient circulation During the operative procedure itself extra care in controlling bleeding, careful apposition of all structures preferably by nonabsorbable sutures, and prevention of necrosis by too tight closure are vital Where there is any question of nutritional deficiencies metal retention sutures should be used, particularly in long and vertical abdominal wounds Abdominal binders an old standby, are probably not of use except as a crutch to attendant or patient and it is doubtful that any reasonable type of dressing can take the tension off the suture line

Since infection is so poorly tolerated by the aged patient careful observation of the wound is essential At the first sign of infection the wound should be opened adequately and widely to permit good drainage and to prevent absorption of the breakdown products possible systemic infection and the pocketing of infection with subsequent chronicity Dressings should not interfere with mobilization Agents should be used which do not necessitate frequent changes

which are painful and may result in a feeling of hopelessness and lack of desire to continue Enzymatic debridement especially with human fibrinolysin trypsin or streptokinase streptodornase (Varidase), has been found to be very useful in these patients since the wound is rapidly debrided without irritation and secondary closure or grafting may be done early Secondary wound healing is accelerated Antibiotics should be used only for very specific indications in wound infections because of their serious complications in long term use

Dehiscence or evisceration can be forestalled even if closure has not been ideal by postoperative care to prevent distention cough hiccup sneezing or straining at stool or to void Distention can be limited if not prevented by measures already outlined continuous suction on an open gastric tube or on occasion a long intestinal tube a rectal tube or low enemas as indicated hot abdominal stupes management of electrolyte balance and preservation of adequate serum and tissue protein levels Straining at stool or to void and overdistention of the bladder are controlled by means already outlined

The safe control of cough may be very difficult as mentioned under pulmonary complications because of the fear of atelectasis or pneumonia If one keeps the mucus liquid by inhalations such as pancreatic dornase for acute situations and potassium iodide or ammonium chloride in long term therapy cough can be controlled by moderate use of codeine synthetic derivatives or antitussive drugs such at Tessalon without too great danger Sneezing of the severity that will produce dehiscence is usually due to allergy or irritation of the nasal mucosa Adrenalin nasal drops or sprays and antihistaminics can be expected to control the sneezing

The treatment of evisceration is no different in the aged from that in any other age group except for the necessity for early detection and treatment just as in other complications At the first sign of this difficulty the dressing should be removed for wound examination The patient may notice a feeling as though the wound has given way or there may be excessive serous or serosanguineous drainage on the dressings Immediate repair is indicated if the patient will tolerate the procedure at all If this is not judged feasible the abdominal contents should be washed carefully with sterile saline and returned to the abdominal cavity and the wound packed with gauze Suitable tight strapping should be applied to retain the contents and decompression of the bowel must be assured Secondary procedures may be necessary as the patient improves

Singultus in the older patient can be a very serious complication aside from the production of dehiscence When prolonged for hours or days it prevents sleep limits intake of food limits adequate respiration and in general weakens and unnerves the patient It may be caused by gastric dilation peritonitis diaphragmatic irritation by pleurisy or subphrenic or perirenal infection or it may be toxic as in uremia One should first rule out gastric distention by being certain that a gastric tube if present is functioning or if not present by introducing one The patient may be asked to rebreathe into a bag or may be given 10 per cent carbon dioxide with oxygen If chemistries and specifically the urea nitrogen are found to be normal more active measures must be taken Heavy sedation or narcosis should be tried if not definitely contraindicated by the patient s condition Chlorpromazine (Thorazine) 25 to 50 mg may stop the hiccups and may be used as often as four times per day with careful observation All these may fail and the next choice will be a difficult one Quinidine sulfate will frequently stop the singultus rapidly and permanently just as it causes reversion of cardiac arrhythmia to normal If the spasm of the diaphragm is unilateral which may be determined by observation of the patient s lower chest and confirmed by fluoroscopy novocaine block of this phrenic nerve can be tried If this is successful but the singultus returns with the

wearing off of anesthesia a longer acting local anesthetic may be used or, more likely, *phrenic crush may be chosen If the action is* bilateral the choice is more difficult If there are *indications for lateralization* of irritation, this phrenic nerve may be blocked in hopes that blocking *the afferent impulse will break* the cycle One may even be forced to perform bilateral block *or crush and to main*tain diaphragmatic function with an automatic pacemaker or respiratory function with a mechanical respirator till normal function returns

PAROTITIS

Parotitis is a complication which seems to be fairly well limited to the older age group and particularly to those with other complications and a drawn out postoperative course It is a serious complication because of the pain and discomfort with any movement of the mouth even speaking and with *attempts to take food by mouth Coming* as it frequently does on the heels of other *complications which have delayed the pa*tient s convalescence and return to normal it may have serious psychological as well as physical import It can be prevented by maintaining adequate hydration and by good mouth care keeping the mouth clean and moist and preventing accumulation of crusts and thick mucus Once present parotitis is difficult to treat unless it is due to an antibiotic sensitive organism which is rare General measures such as the application *of cold to the surface may relieve the dis*comfort Radiation therapy is frequently ef*fective and simple measures* to relieve the pressure of the tight capsule by needling or incision may give rapid relief

PSYCHOLOGICAL CARE

Although not strictly a surgical condition the emotional and psychological *well being* of the patient may be of paramount importance in *his recovery and must* be considered in the decisions *concerning surgical proce*dures and postoperative care Just as with children even at the cost of disturbing hospital and surgical routine, great effort must be made to have the patient s family and friends in frequent contact especially if he be admitted from a good home environment *This strangely enough* is more likely to lead to difficulty with hospitalization than if *the patient has had a* poor home environment A psychological reaction after anesthesia *and operation which prevents return* of the patient to a normal life in spite of an excellent surgical result is as much a surgical failure as *if the patient failed to survive the* operation and may even be worse than the disease for which surgery was undertaken Close observation is essential where the patient is disoriented Side boards are usually considered satisfactory but in fact they are not since patients will climb over them and may seriously injure themselves

If there are evidences of mental *deteriora*tion it is probable that this will progress *under hospital treatment unless every* attempt is made to keep the patient not only *physically but mentally active* This is especially likely to occur with complications and if sedatives or narcotics are used to excess Many of these patients need analeptic therapy in their postoperative course, and this is used too infrequently One may be amazed by the doses of these drugs that older patients will tolerate Amphetamine may be used in large doses but its side effects particularly anorexia and *its sympathomimetic* overaction may be undesirable Ephedrine may be *used but its hypertensive* and sympathomimetic effects are not desirable Piperidine derivatives such as Ritalin are useful stimulants and have fewer undesirable side effects

Where fear anxiety and apprehension are paramount whether associated *with pain* or not there are many useful drugs now available *Almost all* act *also as antiemetics* and permit reduction of narcotic dosage for *relief of pain Many of* the antihypertensive drugs have such an effect Reserpine in particular lessens fear and anxiety in both hypertensive and normotensive patients but

rauwolfia has a similar effect Chlorpromazine (Thorazine) is the most commonly used drug for these purposes It is most useful in combination with reserpine or pentylene tetrazol The combination with pentylene tetrazol is particularly useful, and the latter can be continued as a single drug for a prolonged period The phenothiazine compounds (Pacatal Trilafon) have also been used with success

Where anxiety and excessive stimulation or the reverse of depression and ultimately coma are produced by specific abnormalities such as ammonia retention in liver disease or cerebral anoxia, one must not make the mistake of using nonspecific drugs such as these to cover up the symptoms only to have the basic pathology progress

In ammonia intoxication the withdrawal of old blood low protein diets and ammonia added with therapy such as ammonium chloride or Diamox must be discontinued and treatment with monosodium glutamate or arginine instituted For cerebral anoxia alkalosis must be counteracted with improvement of cerebral blood flow and dissociation of oxygen obtained The fastest method for accomplishing this is addition of carbon dioxide to necessary oxygen therapy

SUMMARY

In summary it can be said that the aged patient suffers from the same postoperative difficulties and the same complications as the younger patient In general the therapy for these complications and the methods for their prevention are similar The differences arise from the fact that the aged patient in general has less resilience and ability to respond to trauma especially if repeated or prolonged Therefore every attempt must be made to prevent complications and if they occur to treat them quickly In addition the aged patient has over the years developed more organ deficiencies many of which may be hidden or compensated for in normal daily life particularly in the cardiovascular renal cerebral and hepatic systems One must always consider these in outlining therapy since it will be of no avail to carry out a successful treatment of the problem at hand only to have another system break down and fail

In general it is important to outline treatment which will affect the patient s normal milieu the least and to carry out this treatment as rapidly as possible It is important to return the patient to normal activity both physical and mental and to return him to his usual environment as rapidly as consistent with good treatment of his basic disease Compromises with the ideal in treatment may be unpalatable to the surgeon but may result in a better all round result than the ideal treatment itself

BIBLIOGRAPHY

Almy T P Roseman D M and Braveman W S Gastrointestinal Hemorrhage in Elderly Patients Bull New York Acad Med 32 337 1956

Bennett H D Hepatitis in the Geriatric Patient Geriatrics 13 345 1958

Bick E M General Principles of Fracture Management in the Aged Surg Gynec & Obst 106 343 1958

Bosch D T Islami A Tan C T C and Beling C A Elderly Surgical Patient Analysis of 500 Consecutive Cases of Patients 60 Years of Age or Older A M A Arch Surg 64 269 1952

Cole W H Operability in Young and Aged Ann Surg 138 145 1953

Cutler C W Jr Management of Surgical Emergencies in the Aged Bull New York Acad Med 32 495 1956

Glenn F Surgery in the Aged Bull New York Acad Med 32 559 1956

Haug C A and Dale W A Major Surgery in Old People A M A Arch Surg 64 421 1952

Ignatius J A and Madding G F Biliary Tract Surgery in the Aged Patient Gastroenterology 34 694 1958

Jacobson H A and Beaconsfield P Emergency Surgery in the Elderly Patient J Am Geriatrics Soc 6 657 1958

LaDue J S Evaluation and Preparation of the Patient with Degenerative Cardiovascu

lar Disease for Major Surgery Bull New York Acad Med 32 418 1956
Limbosch J Experiences with More than 1 000 Elderly Surgical Patients A M A Arch Surg 73 124 1956
Meyer K A Jacobson H A and Beaconsfield P Surgical Treatment of the Octogenarian J Internat Coll Surgeons 29 263 1958
Milch Elmer and Lipp W F Diagnosis and Management of Acute Upper Gastro intestinal Bleeding Geriatrics 13 419 1958
Mitchell R S and Filly C F Diffuse Obstructive Pulmonary Emphysema A Poorly Understood Disorder Postgrad Med 23 156 1958
Titchener J Zwerling I Gottschalk F and Levine M Psychological Reactions of the Aged in Surgery A M A Arch Neurol & Psychiat 79 63 1958

Part 2

Surgery of the Thorax and Thoracic Wall

6

Cancer of the Breast

William A Cooper

Cancer of the breast in older people has long been thought to differ in certain ways from the same disease in younger people Its course is generally considered slower or more benign and the prognosis therefore somewhat better The purpose of this study is to see whether or not this is actually true in a series of cases at The New York Hospital To shed light on the matter all cases of breast cancer admitted to the ward services from 1932 through 1953 are reviewed and the course of the disease is analyzed The patients are divided into two groups—those over and those under 60 years of age—and the two groups are compared in various ways

This series was started in the third quarter of 1932 and has gradually grown each year It represents the efforts of many persons over a period of 26 years The operations were performed by a long series of resident surgeons working under the direction of an attending staff whose basic policies have remained remarkably constant Perhaps the greatest value of this series is found in two of its features the cases have been unusually well followed and the information is therefore extraordinarily complete and the length of the series affords a perspective on the course of breast cancer not to be found in shorter experiences This latter feature will be discussed in the portion of this study concerned with an analysis of the cases followed for 10 years or longer

All patients admitted to the ward services with a diagnosis of breast cancer are included in this study No cases are excluded The occasional lost case is statistically considered as dead of cancer It is felt that this gives as true a picture of the disease as is possible from the author s experience

Table 6 1 shows the distribution of these cases over the years Less than 5 per cent of the patients were not followed after operation This truly remarkable follow up for patients in a large metropolitan population was made possible by the diligent efforts of a well run follow up organization in the Department of Surgery

Table 6 1 shows that there was great variation from year to year in the incidence of metastases to the axillary nodes It was hoped that over the 22 year period this would show some decrease in the incidence of metastatic disease or some indication that cancer of the breast was being seen and treated earlier In the first 11 years 54 7 per cent of the patients had axillary metastases in the second 11 years 51 4 per cent This 3 per cent improvement of one decade of experience over the other is of questionable significance At best it can be interpreted as only a slight trend in the right direction

The percentage of axillary negative and axillary positive cases was determined for those under 60 and compared with those over 60 There was not more than 2 per cent difference This supports the view that at the

TABLE 6-1 DISTRIBUTION OF BREAST CANCER CASES BY YEAR, 1932-1953

Year	Total cases	Not operated on	Simple mastectomy	Radical mastectomy	Operative deaths	Operative survivors	Axillary nodes neg	Axillary nodes pos
1932	7	1	0	6	0	6	3	3
1933	35	10	1	24	1	23	5	19
1934	28	6	5	17	0	17	8	9
1935	27	4	3	20	1	19	11	9
1936	31	6	4	21	0	21	12	9
1937	41	9	3	29	2	27	14	15
1938	34	3	1	30	2	28	10	20
1939	47	8	1	38	0	38	21	17
1940	38	4	2	32	0	32	11	21
1941	50	7	1	42	0	42	26	16
1942	28	1	1	26	0	26	8	18
1943	34	4	2	28	0	28	17	11
1944	32	9	1	22	0	22	8	14
1945	37	3	2	32	0	32	16	16
1946	36	3	3	30	0	30	17	13
1947	32	5	3	24	1	23	13	11
1948	40	10	1	29	0	29	16	13
1949	58	14	0	44	1	43	17	27
1950	63	13	3	47	1	46	21	26
1951	45	6	2	37	0	37	21	16
1952	33	4	1	28	0	28	13	15
1953	35	6	0	29	0	29	11	18
Total	811	136	40	635	9	626	299	336
Per cent	100	16.8	4.9	78.3	1.4	98.6	47.1	52.9

time of operation there is little if any difference between the older and younger patients as far as extent and spread of disease are concerned

AGE DISTRIBUTION OF ENTIRE SERIES

The age of the patients in this study is shown numerically and graphically in the following graph (Fig 6.1) The age used is the nearest year at the time of admission

It is noted that 585 patients or 72.1 per cent of the entire group of patients were under 60 years of age while 226 patients or 27.9 per cent, were over 60

Unoperated Cases

Table 6-1 shows that 136 of the 811 cases or 16.8 per cent, were not operated on These 136 cases fell into three groups

1 Patients who had had a radical mastectomy elsewhere and were admitted here with some manifestation of recurrent or metastatic disease

2 Patients with inoperable breast cancer not treated elsewhere including the occasional case in which distant metastases were the first manifestation of breast cancer

3 The rare operable case that refused operation or treatment

Many of these 136 patients had palliative or diagnostic procedures of one type or another performed here These included various neurological operations for the relief of pain bilateral adrenalectomy total hypophysectomy biopsy secondary excisions and other procedures They comprise a heterogeneous group which for the purposes of this study, is excluded from this point on Needless to say most of these patients either are dead or are living with clinical evidence of disease

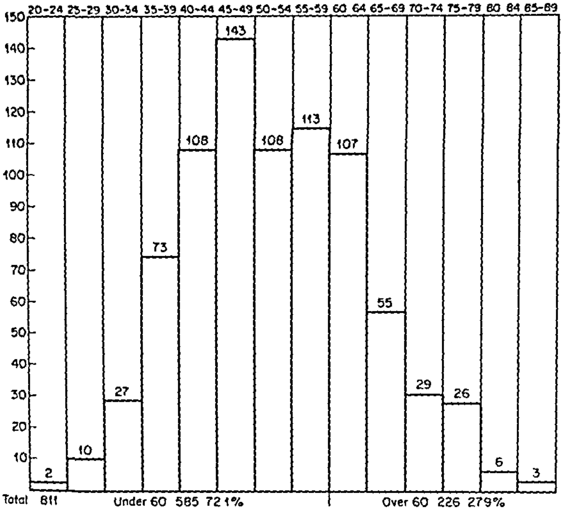


Fig 6-1 Age distribution of patients with breast cancer 1932-1953

Nonoperative Treatment

Nonoperative palliative treatment in the form of steroids or x ray therapy was used in many of the cases not operated on and also in many of the patients with recurrence after simple or radical mastectomy Most of these were treated as ambulatory patients in the outpatient department No effort is made to evaluate the results of this palliative therapy High voltage x ray radiation female hormones male hormones bilateral adrenalectomy total hypophysectomy and castration have all caused objective regression of selected tumors In many cases the treatment was mixed It is difficult if not impossible in this series to evaluate long term palliation or to ascribe survival with disease to one or another of these agents or procedures

It should be emphasized however that except for x ray therapy given more or less routinely after the removal of breasts with axillary metastases and the occasional prophylactic castration these ancillary therapeutic measures have been confined to patients with recurrent or inoperable disease The 3 5 and 10 year figures used in this analysis are therefore largely the result of surgery alone or surgery plus x ray therapy in the patients with axillary metastases

Simple Mastectomy

Of the 811 total cases 40 or 4 9 per cent had simple mastectomy Of these 19 were under 60 and 21 over 60 About half the simple mastectomies were done as palliative procedures for advanced disease to rid pa

tients of ulcerating breast lesions, and all these patients were dead within 3 years In the other half, radical mastectomy was withheld and simple mastectomy done because the risk of operation was a factor In some the cardiac status was the predominating factor, in others age influenced the decision Some of these died a cardiac death with cancer, but there are 11 cases that did well without any other operative procedure Five patients under 60 lived or are living 24, 23 21, 10, and 6 years respectively, after simple mastectomy One of these had Paget s disease of the nipple without any demonstrated breast cancer Six patients over 60 lived or are living 18, 16 15 13, 10 and 6 years respectively after simple mastectomy Only one of these older persons, the one that lived 18 years died of cancer (at the age of 90)

The purpose of these comments is not to suggest that simple mastectomy is the procedure of choice in older patients for the author believes this to be untrue, but to demonstrate that simple mastectomy may be adequate in rare instances These occasional favorable results are probably more the result of good fortune than of fine judgment The unoperated cases as well as the simple mastectomies are excluded from further consideration in this study

Operative Mortality

In spite of the predominance of cardiovascular lesions in the older age group these factors had less influence on operability complications and mortality than might be expected In many of these patients the pre- and postoperative management was a major problem yet with the judicious use of digitalis diuretics insulin, and competent medical management most of the older patients tolerated the radical operation The operative mortality was low in both age groups 0 6 per cent for those under 60 4 per cent for those over 60 1 4 per cent for the entire 635 radical mastectomies The causes of these fatalities are listed below

Under 60

1 Coronary occlusion
2 Infection
3 Brain metastasis

Over 60

1 Septicemia
2 Pulmonary embolus
3 Bleeding *polycythemia vera*
4 Perforated ulcer
5 Cerebral accident

It is apparent that the risk of operation is six or seven times as great in older patients but is still not formidable The two deaths due to infection antedate the antibiotic period as do those due to pulmonary embolism They would be less likely to occur today

Complications following operation were more frequent and more serious in the older age group yet, as the mortality figures show were rarely fatal The most serious complications involved the vascular system—either coronary occlusion or embolic phenomena The most common complications were those connected with the wound such as loss of part of the skin graft, this latter occurred irrespective of age

Other Diseases

In any group of patients followed over a period of many years as this group has been the incidence of other disease could be expected to be high This was true of the patients with breast cancer The other disease occurring before, concurrent with or after the breast lesion covered a broad spectrum of the diagnostic index Two entities occurred most frequently lesions of the thyroid gland and of the gallbladder The incidence of thyroid disease requiring operations usually toxic goiter was 47 in 626 patients The incidence of cholelithiasis requiring operation was 57 in 626 patients and was most common in the older group It should be noted that these cases include only those of thyroid or gallbladder disease requiring operation in The New York Hospital whether before at the same admission or after that for breast cancer If a careful search for these diseases were made in each of the patients in the series, the incidence would no doubt have been much higher

It is interesting to speculate upon the significance of the incidence of thyroid and gall bladder disease in breast cancer but if there is any, it is not known The influence of the endocrine glands upon the growth of breast cancer though poorly understood has become increasingly apparent in recent years and the thyroid as an integral part of the endocrine system, might be expected to show some changes It seems likely that the thyroid changes may be an expression of more fundamental endocrine disturbances originating perhaps in the pituitary There is no suggestion from the clinical data that thyroid dysfunction in anyway causes or influences the course of breast cancer The ovaries adrenals and pituitary seem more directly involved

The significance of the incidence of cholelithiasis is even more speculative Though the exact mechanism is obscure, it is known that gallstones are an expression of some disturbance in the metabolism of cholesterol, which is also influenced by thyroid function It is possible that some defect in cholesterol metabolism is a background against which breast cancer is more likely to develop

Radical Mastectomy

Over the 22 year period of this study the policy of the Department of Surgery regarding breast cancer has remained fairly consistent it is as follows

1 The primary treatment of breast cancer has been surgical

2 The operation used has been the Halsted radical mastectomy sacrificing wide areas of skin and using split thickness grafts to cover the defect

3 Patients have been considered operable unless metastatic or spreading disease was *demonstrable* beyond the scope of the operative area This interpretation of operability has been very liberal perhaps too much so but can be defended by the occasional long term survivors who preoperatively seemed to have a poor prognosis

4 Postoperative x ray therapy was usually given to those patients with axillary metastases and omitted in those without

5 Sterilization by x ray therapy or operation has been used in some premenopausal patients but was not a consistent policy

Referring back to Table 6 1, 635 patients or 78 3 per cent of the entire series were subjected to radical mastectomy Of these, 626 or 98 6 per cent survived the operation It is this latter group that will be analyzed for cures

Results

A very real problem in breast cancer is the evaluation of therapy For the purposes of this analysis, we have selected a simple albeit inaccurate and inadequate method The method is to divide the number of patients living and free of clinical evidence of disease 3 5 and 10 years after radical mastectomy by the number surviving radical mastectomy This method is simple in that it allows for a comparison of easily comprehensible percentages it is inaccurate in that these percentages are lower than they should be because those patients lost and dying of other diseases are counted as dead from cancer it is inadequate in that it fails to reflect the course of breast cancer and the fact that some patients tolerate their disease for many years eventually dying of other diseases with or without residual tumor These matters can best be appreciated by those who have given some thought to the problems of statistics

Another method that might have been used in reporting this series is 3 , 5 and 10 year survivors or those patients living regardless of the clinical evidence of tumor present at 3 5 and 10 years after operation Had this method been used the figures in most of the tables that follow would have been at least 10 per cent higher

The 3 year 5 year and 10 year cures divided into those under and over 60 years of age are shown in Table 6-2 which shows that the over all 3 and 5 year cures are about 5 per cent better in those patients over 60 years of age The trend is reversed at the

TABLE 6 2 THE RELATION OF AGE TO "CURE'

	No of cases	3 yr cures	5-yr cures	10-yr cure
All cases (operative survivors)	6 6	5 7%	4 4%	33 4%
Under 60	4	54 %	46 %	34 6%
Over 60	151	9 9%	51 3%	6 3%

10 year level about 8 per cent fewer older patients qualifying This is because 10 years in the older age group finds many apparent cures dying of other diseases many without tumor and some with This emphasizes the *inaccuracies of the simple method of anal* ysis It is probably accurate to conclude that in this series the patients over 60 do at least 5 per cent better than those under 60

It is generally thought that cancer limited *to the breast is likely to have a better prog* nosis than that with axillary metastases The differences at 3, 5, and 10 years in those with and without axillary involvement are shown in Table 6 3 In general the prognosis *is about twice as good in those without axil* lary metastases

The axillary positive and axillary negative patients are further divided into those over and under 60 in Table 6 4 which shows that *in patients with axillary metastases there is* nearly a 10 per cent difference in cures at the 3- and 5 year levels in favor of the other group The fact that there is practically no difference at the 10 year level is attributable *to deaths in the older patients from other* diseases This difference is not present in those patients without axillary metastases those under and over 60 being about the same, except for the 10 year period which *is distorted by deaths from other causes* These figures seem to demonstrate two things (1) that patients over 60 with meta static disease do somewhat better i e the disease progresses more slowly, (2) that pa *tients without metastases do about the same* regardless of age

TABLE 6-3 THE RELATION OF AXILLARY METASTASES TO CURE

	No of cases	3-yr cures	5-yr cures	10 yr cures
All cases (operative survivors)	6 6	55 %	47 4%	33 4%
With axillary metastases	335	39 6%	31 0%	19 1%
Without axillary metastases	299	72 5%	64 6%	4 %

TABLE 6-4 THE RELATION OF AGE AND AXILLARY METASTASES TO 'CURE'

	No of cases	3 yr cures	5-yr cures	10-yr cures
Cases with axillary metastases	33	39 6%	31 0%	19 1%
Under 60		3 3%	%	19 0%
Over 60		45 1%	30 0%	0 0%
Cases without axillary metastases	99	%	64 6%	4 %
Under 60		7 0%	64 %	51 1%
Over 60		73 0%	64 9%	31 1%

Bilateral Radical Mastectomy

In 29 of the 639 operable patients in this *series or 4 5 per cent bilateral radical mas* tectomy was performed Analyzing these 29 patients separately yields results of some interest which are shown in Table 6 5

Thirteen of the twenty nine patients are *still living 4 of them for 20 or more years* These results are somewhat better than the over all rate shown in Table 6 2 and clearly indicate that the occurrence of the disease in both breasts is no contraindication to rad ical surgical treatment

The bilateral operation was done in the same admission on 5 patients, the other 24 *having an interval that varied from 6 months* to 21 years In 7 cases the operations were

TABLE 6-5 THE CURE RATES IN DOUBLE MASTECTOMY

Total cases	3-yr cures	5-yr cures	10-yr cures
29	22/29 75 9%	19/29 65 5%	13/29 44 8%

10 or more years apart. Concurrent lesions or those with a short interval suggest unilateral origins, while those with a long interval suggest separate lesions. Though morphology of the two lesions may suggest a common origin, it is seldom conclusive. If in fact the two lesions are individual cancers, this strongly supports the presence of as yet unidentified constitutional or congenital factors that predispose to breast cancer. Quite aside from theoretical considerations, the experience with these 29 patients suggests that bilateral breast cancer is often biologically low grade, with a better than average prognosis.

WHAT HAPPENS TO 10-YEAR "CURES"?

The long term nature of this series of cases affords a unique opportunity to learn what happens to the breast cancer patient who has been fortunate enough to survive 10 or more years after radical surgery. The perspective of 25 years brings out certain features that are not apparent at the 5- or 10-year levels.

Referring back to Table 6-2, it is noted that of the 443 operative survivors operated upon 10 or more years before, 33.4 per cent lived 10 or more years. This percentage represents 148 patients, many of whom are now dead, some because of breast cancer and some because of other diseases. Analysis of these 148 cases is shown in Table 6-6.

It should be noted that 25 of the deaths (about 50 per cent) after 10 years were due to other diseases, while 15 were due to late recurrences of breast cancer. Nine patients were lost, all from the tenth to fifteenth year of follow-up. Elsewhere in this analysis the lost cases have been recorded as dead of cancer. The latest recurrence in the series was free of clinical evidence of disease in the twenty-second year after operation, only to die with widespread metastases in the twenty-third year.

In regard to the 20-year "cures," we find that out of 113 patients (Table 6-1) that survived operation 20 or more years ago, 41

TABLE 6-6. DISTRIBUTION OF PATIENTS LIVING 10 OR MORE YEARS AFTER RADICAL MASTECTOMY

Years after operation	No. living in 1958	Deaths not due to cancer	Deaths due to cancer	Lost track of after this year
10	118	3	0	2
11	132	3	3	3
12	117	5	4	1
13	91	2	0	2
14	90	1	2	1
15	83	2	1	
16	71	0	0	
17	63	0	1	
18	52	2	1	
19	44	0	1	
20	41	4	1	
21	29	0	0	
22	22	1	0	
23	18	2	1	
24	11	0	0	
25	5	0	0	
26	2	0	0	
Total		25	15	9

patients (Table 6-6), or 36.3 per cent, were living 20 years after radical mastectomy. Thirty-two of these patients are still alive. It is interesting to note that 12 of the 41 patients had axillary metastases, while 29 were free of any evidence of extension.

DISCUSSION

It should be emphasized that the patients that survive 10 or more years are a highly selected group. Most rapidly progressive disease has long since been eliminated, largely by its own ravages, leaving two groups of patients: (1) actual cures in whom all trace of the disease was removed by the radical operation and (2) patients who are not cured but who tolerate their disease much better than the average. In the actual cures, the surgeon can take full credit; in the latter group, nature itself has been a strong ally. Nor is it possible accurately to separate these two groups, for each passing year turns "cured" patients into "tolerant" patients, though this occurrence becomes less frequent as the years go by. Perhaps these considera-

tions are more theoretical than practical but retrospection breeds humility, and evaluation of our all too ineffective methods, old or new, requires some perspective

This long term experience focuses attention on present day policy regarding breast cancer Some students of the problem feel that the presence of metastatic disease in the axillary or internal mammary nodes makes radical mastectomy unrewarding They advocate simple mastectomy and x ray therapy for such cases Though their observations cannot be questioned the impact of these 20 year cures who had axillary metastases can hardly be ignored Would these patients have done just as well with simple mastectomy and x ray therapy? While the author cannot categorically answer this question, the experience of this series certainly tends to justify the radical surgical approach to the problem of breast cancer

Fundamental questions that influence policy concern the effect, if any of the removal of primary breast lesions It is perfectly clear that breast cancer spreads from the original lesion by way of the lymphatics the blood stream, or both It seems reasonable to assume that surgical removal of this source of spreading disease might slow its natural progress even though it failed to eradicate completely or to cure The later recurrences support this assumption There is much to suggest that many of the late recurrences occur when the disease breaks through boundaries that have long held the disease in abeyance such as scar tissue or lymph nodes Certainly clinical cancer in lymph nodes is better tolerated than that involving the viscera This line of reasoning based on clinical interpretations, plus the occasional 20 year cures of patients with secondary axillary nodes strongly supports the radical mastectomy policy followed over the years in this series of cases

Though certain prejudices are entertained favoring the liberal use of radical surgery it is only fair to mention certain clinical facts that do not support this policy The 45 per cent of deaths occurring in the first 3 years after surgery suggests that incidental manipulation may, in fact spread the disease This is best illustrated by the patient with a small primary lesion without axillary metastases who dies in the first year after operation with widespread metastases Does the radical surgical policy sacrifice many to save a few? The author has no answer to this question Nor are comparisons between this series and others treated differently very convincing to the student who looks beyond the quoted percentage to the fraction it represents and the selection of patients that go into each numerator and denominator It is to be hoped that time and further study may clarify some of these fundamental questions concerning cancer of the breast

SUMMARY

The patients with a diagnosis of cancer of the breast admitted to the ward services of The New York Hospital from 1932 through 1953 are analyzed Of 811 patients, 136 (16 8 per cent) were not operated upon 40 (4 9 per cent) had simple mastectomy and 635 (78 3 per cent) had radical mastectomy There were nine operative deaths (1 4 per cent) and 626 patients survived radical mastectomy

In the patients treated by radical mastectomy 299 (47 1 per cent) had no axillary metastases while 336 (52 9 per cent) had secondary axillary involvement There were 3 per cent more axillary negative patients in the second half of this series suggesting that the disease was seen slightly earlier in its course in more recent years

The age distribution chart showed 72 1 per cent of the series to be under 60 years of age and 27 9 per cent over 60 The ratio of axillary negative to axillary positive cases in those under and those over 60 was about the same suggesting that the two age groups were clinically comparable

In spite of frequent serious cardiovascular disease in the older age group the op

erative mortality was 4 per cent age alone was rarely the determining factor in selecting treatment

The results of radical mastectomy, usually without x ray therapy in the axillary negative cases and with x ray therapy in patients with positive nodes are 55 7 per cent 3 year cures 47 4 per cent 5 year 'cures and 33 4 per cent 10 year cures Patients over 60 did almost 5 per cent better than those in the younger group

The 5 year cures in the axillary negative patients were 64 per cent in the axillary positive patients 31 per cent

When axillary negative and axillary positive cases were divided into those under and those over 60 the older group with metastases did about 10 per cent better than the younger group There was practically no difference in the two age groups in axillary negative cases

In 29 bilateral radical mastectomies the results at 3 5 and 10 years after operation were somewhat better than in the unilateral mastectomies

The results in patients followed more than 10 years are shown in detail There were 41 patients with 20 year cures 12 of whom had axillary metastases at operation There were at least 15 recurrences 10 years or more after operation

The significance of these findings is discussed in its relation to the radical operation

Patients over 60 have a somewhat better prognosis (about 10 per cent) than those under 60

BIBLIOGRAPHY

Haagensen C D *Diseases of the Breast* W B Saunders Company Philadelphia 1956 p 340

Handley R S and Thackray A C Invasion of Internal Mammary Lymph Nodes in Carcinoma of the Breast Brit M J 1 61 1954

Harrington S W Survival Rates of Radical Mastectomy for Unilateral and Bilateral Carcinoma of the Breast Surgery 19 154 1946

Macdonald I Mammary Carcinoma A Review of 2 636 Cases Surg Gynec & Obst 74 75 1942

Nathanson I T and Welch C E Life Expectancy and Incidence of Malignant Disease Carcinoma of the Breast Am J Cancer 28 40 1936

Taylor G W and Nathanson I T Lymph Node Metastases Oxford University Press New York 1942 p 94

7

Cancer of the Lung

S W Moore

On April 5 1933 Evarts Graham first successfully performed a pneumonectomy for carcinoma of the lung Twenty five years later Dr Graham introduced this patient at a meeting of the American College of Surgeons in one of the most dramatic presentations the author has ever seen April 21 1959 twenty six years after operation this patient a physician is still actively engaged in practice This was a major break through showing that carcinoma of the lung could be treated surgically

Since 1933, there has been a tremendous increase in carcinoma of the lung and it is now the commonest cause of death from cancer in the male Occurring predominantly between the ages of 50 and 70 it is rapidly fatal if untreated Surgery remains the treatment of choice Elderly patients can undergo extensive intrathoracic surgery with a very low mortality rate when they have been properly evaluated and prepared and when they manifest a will to survive the procedure

INCIDENCE

The death rate from cancer of the lung in white men rose from less than 4 for 100 000 population in 1930 to 19 for 100 000 in 1950 These figures from the American Cancer Society demonstrate almost a 500 per cent increase Over a 20 year period at The New York Hospital cancer of the lung increased 462 per cent while total admissions increased only 87 per cent (Fig 7 1) Similar trends are reported throughout the entire Western world With the widespread use of chest roentgen ray surveys many more tumors of the lung are now brought to light than were formerly disclosed Cancer of the lung has become one of our most pressing problems

Incidence in the Aged

Cancer of the lung is rare under age 40 rises rapidly to age 50 to 59 and then remains almost constant in incidence for the remaining age groups (Figs 7 2 and 7 3) In The New York Hospital series for the past 3 years (1956 1957 1958) there has been a marked but unexplainable decrease in the number of patients over age 60 with cancer of the lung (Fig 7-1)

ETIOLOGY

For years it has been known that the miners in Schneeburg Germany and Joachimsthal Czechoslovakia developed carcinoma of the lung much more often than persons in the same area who worked in other mines This was thought to be due to a high concentration of radium uranium or arsenic found in the rocks in these mines

The studies of Graham of Wynder and Graham and of Doll and Hill adduce considerable evidence to associate smoking of cigarettes with carcinoma of the lung Although proof of definite relationship has not been established there is a large amount

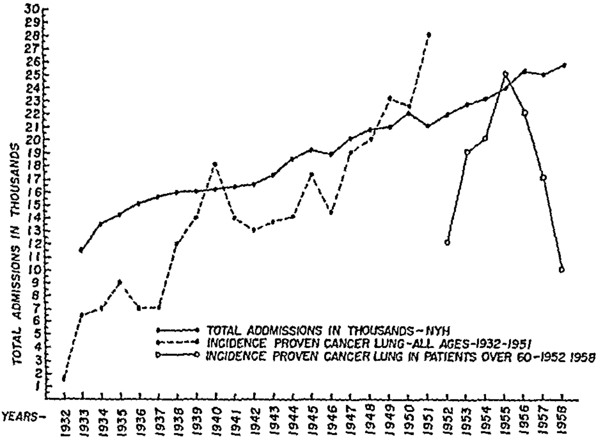


Fig 7 1 Total admission in thousands to The New York Hospital over a 26 year period The dotted line represents the marked increase in proved cancer of the lung in all age groups The solid line on the right shows the incidence of proved cases of cancer of the lung in patients over age 60 There is no explanation for the marked decline in this last curve over the past 3 years

of data to implicate cigarette smoking as a most important factor in causing lung cancer

Auerbach et al in autopsies on patients dying of cancer report histological studies which are consistent with the hypothesis that inhalants particularly cigarette smoke are important factors in the causation of bron chogenic carcinoma It is true that the other inhalants particularly in cities may also be indicted

Auerbach and his group also give evi dence that carcinoma of the lung occurs pre dominantly in smokers There is widespread reaction to the irritant and in those patients who develop carcinoma it arises from mul tiple contiguous foci With frank carcinoma of the lung the majority show evidence of carcinoma in situ in other areas This may in part explain the discouragingly low cure rate in that their studies suggest that so-called recurrences and metastases in some cases result from foci of carcinoma in situ progressing to frank carcinoma

In 255 patients over age 60 with carci noma of the lung studied at The New York Hospital where a definite statement is made 160 are described as smokers and 10 as nonsmokers

PATHOLOGY

The three main types of carcinoma of the lung are epidermoid anaplastic and adeno carcinoma Epidermoid is the most com mon is most amenable to surgical therapy and apparently is most closely associated with smoking (Fig 7-4) In the author s ex-

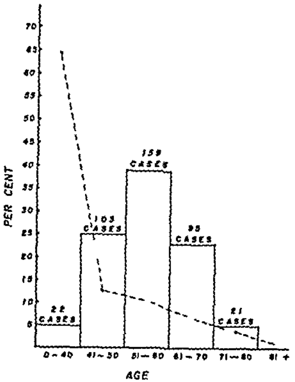


Fig 7 2 Total cases of cancer of the lung plotted against the percentage of the total population in the various age groups There is a marked rise in incidence until age 60 following which the incidence of cancer of the lung parallels the total population (all ages) (*S W Moore and D R Cole Primary Malignant Neoplasms of the Lung Ann Surg* 141 457 1955)

perience this tumor is more apt to be located in the hilar region of the lung than in the periphery (Fig 7 5)

Carcinoma of the lung spreads locally by way of the lymphatics involving first the mediastinal and then the distant lymph nodes Blood vessel invasion is very important and frequently *the first sign of spread* is a distant metastasis often to the brain Metastasis to the brain occurs in 28 per cent of cases where cancer of the lung is the primary cause of death and is a most important source of metastatic brain tumors The high rate of metastasis to the adrenals (47 per cent at autopsy) has puzzled many Its occurrence has been explained by direct spread through the lymphatics in the diaphragm from the lung to the adrenals (Fig 7 6)

Collier et al, in reviewing their cases find that the *presence or absence of blood vessel invasion* is the most important single factor in prognosis In patients with blood vessel invasion they find a 6 *per cent 5 year survival* whereas without blood vessel invasion they find a 75 per cent 5 year survival This in their experience is a much better indication of prognosis than lymph node invasion which has been used by most investigators Others find that the most important prognostic factor is the cell type

DIAGNOSIS

In the early stage when cure rate is high correct diagnosis is quite difficult and often impossible In the later stages when diag

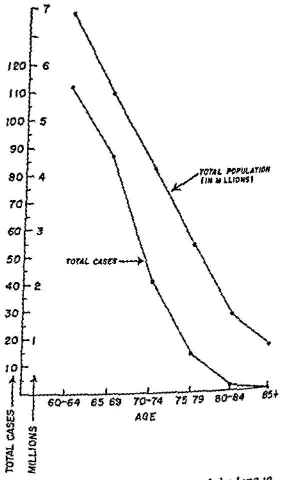


Fig 7 3 The incidence of cancer of the lung in the aged compared to the *total population* The curves are almost identical

nosis is easy, the chances of cure are small Early diagnosis rests primarily upon a high index of suspicion by the first physician who sees the patient The possibility of carcinoma must be considered in every man past 40 years of age with a cough hemoptysis chest pain respiratory infection sputum, weight loss dyspnea a wheeze or hoarseness Unfortunately however these symptoms are largely the result of complications or spread of the carcinoma rather than of an early lesion

Early carcinoma has no symptoms The earliest sign we are able to find is usually an abnormal shadow in the roentgen ray film Although this is not pathognomonic it alerts the physician and enables him to make further studies It is well known that roentgen-ray evidence of carcinoma of the bronchus may be present for years before the patient appears for treatment It is most important to emphasize however that at times the

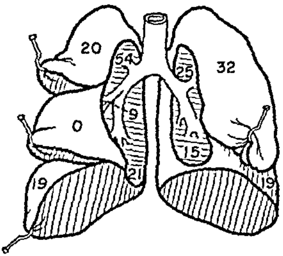


Fig 7 5 Of 401 proved cancers of the lung 214 could be accurately located in one of the areas shown above (all ages) (*S W Moore and D R Cole Primary Malignant Neoplasms of the Lung Ann Surg* 141 457 1955)

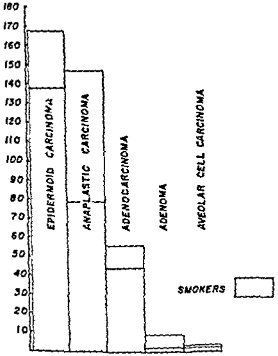


Fig 7 4 Types of tumor classified and showing the number of each type occurring in smokers (all ages) (*S W Moore and D R Cole Primary Malignant Neoplasms of the Lung Ann Surg* 141 457 1955)

carcinoma may manifest itself by symptoms primarily hemoptysis and may nevertheless be ignored because of negative chest roentgen ray results

Hemoptysis is a frightening symptom When it occurs the examiner has an opportunity to make a rapid determination of the underlying cause of bleeding If the roentgen ray examination is completely negative it is imperative that a bronchoscopy be carried out for it is in these cases that this procedure should be most helpful

To cure cancer of the lung it must be diagnosed in the early stages For this reason laboratory aids are most important Roentgen ray examination has proved to be the most helpful single tool Both anteroposterior and lateral films should be taken Although not pathognomonic in the early stages these alert the physician to the possibility of cancer and impel him to carry out further procedures Every effort should be made to achieve an accurate diagnosis as soon as possible Because of the high incidence of malignant lesions in which the diagnosis is uncertain they should not be watched for more than a few weeks

Where sputum is present bacteriologic

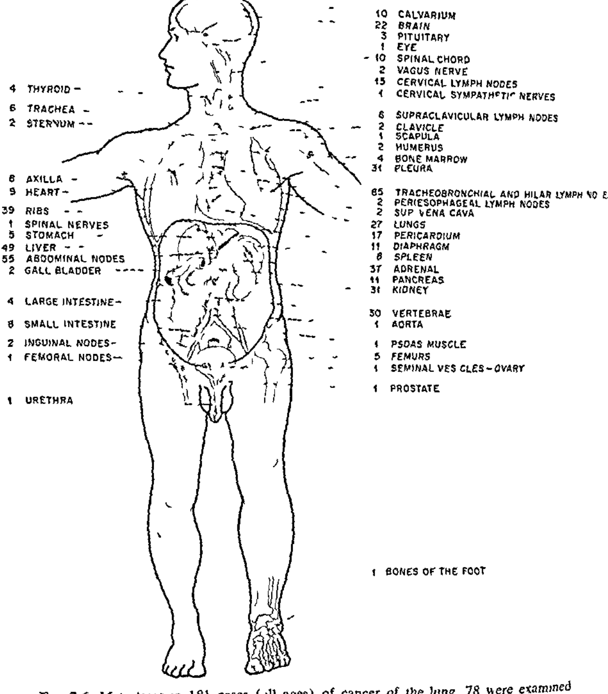


Fig 7 6 Metastases in 181 cases (all ages) of cancer of the lung 78 were examined post mortem (*S W Moore and D R Cole Primary Malignant Neoplasms of the Lung Ann Surg* 141 457 1955)

studies Papanicolaou smears skin tests serum agglutinin tests and bronchoscopy are usually necessary Any aspirate should be studied both bacteriologically and by Papanicolaou smears When bronchiectasis is suspected bronchograms are necessary It should always be remembered that thoracotomy is used not only in therapy but also as a final diagnostic procedure in undetermined lesions

Anterior scalene node biopsy has a double purpose (1) the histologic confirmation of the presence of a malignant tumor (2) the determination of inoperability When positive tissues are found in the neck it may be assumed that the lesion is inoperable

Exploration can also be carried into the superior mediastinum and when tissue positive for cancer is found the lesion is also probably incurable For lesions of the right lung the right neck should be explored For lesions of the left upper lobe the left neck should be explored and for the left lower lobe both sides of the neck should be explored It is very important to remember that scalene node biopsy is most helpful in detecting lung tumors arising from the upper lobes or smaller peripheral bronchi These are the ones most difficult to diagnose by means of bronchoscopic biopsy

Tissue for histologic examination and material for Papanicolaou smears may be obtained by bronchoscopy This examination is most useful for carcinomas in the region of the hilum and the lower lobes but it is not nearly so satisfactory for neoplasms of the periphery and the upper lobes By means of bronchoscopic examination a positive diagnosis should be made in some 40 per cent of patients with primary lung tumor

Positive cytologic smears are not as frequently encountered in patients with peripheral tumors as they are in those with central tumors Nevertheless this procedure is far more successful than bronchoscopic examination in diagnosing carcinoma in the periphery of the lung

Utilization of these three forms of diagnosis—scalene node biopsy bronchoscopy and Papanicolaou smear—permits a preoperative microscopic diagnosis of carcinoma in some 80 per cent of tumors It is important to point out however that the resectability and cure rate is higher in those patients with a negative cytologic smear or bronchoscopic examination and lower where these examinations are positive The moral is that exploratory thoracotomy still remains a diagnostic procedure

ASYMPTOMATIC CANCER

All writers agree that patients in the asymptomatic group or survey cases consisting of a solitary nodule in the periphery of the lung picked up on routine chest plates have the most favorable prospect for surgical cure When other conditions are ruled out and all tests for cancer are negative these patients come to exploratory thoracotomy Their survival rate, reported up to 75 per cent is higher than that of any other group

INOPERABILITY

It is difficult to say what is absolute inoperability However, patients with tracheal invasion distant metastases or positive pleural fluid are considered inoperable Invasion of the chest wall paralysis of the left recurrent laryngeal nerve angiocardiographic evidence of invasion or obstruction of the superior vena cava all show that there is very little likelihood of successful outcome

VARIATIONS IN CLINICAL COURSE

Once symptoms develop carcinoma of the lung is in the later stages Rigler through a series of fortuitous circumstances and realizing that this condition is usually present for long periods of time before the onset of symptoms has been able to study the evolution of carcinoma of the lung by roentgen ray examination In a selected series of cases he found that 50 per cent showed roentgen ray evidence of the disease more than 2 years prior to symptoms or determination of a definitive diagnosis It is his feeling that numerous cases arise as peripheral lesions and extend centrally with late invasion of a major bronchus This peripheral lesion may give no symptoms but these arise only on involvement of a large bronchus The beginning of symptoms may be concomitant with the development of distant metastases When cavitation occurs within a peripheral mass symptoms will usually supervene rather rapidly This is also borne out by the fact that the prognosis in the peripheral lesion is much better

The presence of the bronchogenic carcinoma may be heralded by hemoptysis but

with negative roentgen ray examination this symptom may be ignored This emphasizes that any single test does not rule out cancer Patients with hemoptysis and a negative roentgen ray examination are often diagnosed accurately by means of a bronchoscope There are *numerous reports that* bronchogenic carcinoma may arise from multiple sites within the bronchial tree and often goes unrecognized until there is coalescence of two or more independent lesions The development of these other lesions may well be the origin of later recurrences It is *well known that a patient with carcinoma* has a much better opportunity to develop a second primary than a patient who has had no tumor

The usual course of carcinoma of the lung in the aged once symptoms develop and without complete surgical removal is rapidly *downhill to death the majority within* 6 months and almost all within 2 years

Budinger in a clinical and pathologic study of 250 autopsied cases of untreated bronchogenic carcinoma at the Boston City Hospital finds that 144 or 58 per cent were over the age of 60 This is a most important *point as in most operative series the majority* are under 60 The average clinical history of these patients was 10 months with a range of 2 weeks to 21 months In 33 patients (13 per cent) a metastatic focus was *the first evidence of lung disease In 17 of* these (7 per cent) the symptoms and signs were related to a damaged brain Nine (4 per cent) appeared as typical strokes due to hemorrhage Eight (4 per cent) were indistinguishable from primary brain tumor until completely studied At the time of death *58 cases (23 per cent) were incorrectly diagnosed*

PREOPERATIVE EVALUATION

Cole finds that both the mortality and the morbidity in major operations of slight magnitude are about the same in elderly as they are in young patients However with a greater magnitude in operation the mortality rate may be two to four times higher than in the young group *Concurrent or complicating* diseases tend to elevate the mortality rate more in elderly than in young patients Again emergency operations are tolerated less well than elective procedures *Emergency procedures have a mortality of 18 per* cent and elective, a 6 per cent mortality

The mental status of elderly patients is always quite important The persons who manifest a will to survive and give evidence that they can accept the discomfort and inconvenience of an operation in return for *the prospect of long life will do surprisingly* well

The usual complications which affect this group of patients have to do largely with the heart and lungs, in the main pulmonary insufficiency cardiac insufficiency and malnutrition The prognosis in the aged with car*cinoma of the lung is usually not much dif*ferent from that in those under the age of 60

In the preoperative evaluation the respiratory reserve should be carefully evaluated particularly in those patients with emphysema Cardiac reserve again *should be as*sessed cardiac failure accounting for some 20 per cent of total deaths and occurring twice as often in patients over the age of 60 as in those under 60 With advancing years, physiologic changes which alter the *function* of organs and tissues include (1) reduced *pulmonary reserve* (2) cardiac disease (3) vascular disease and (4) alteration of nutritional status This includes both *malnutri*tion and obesity *Most important of these is reduced pulmonary reserve* This is doubly important because *pulmonary* reserve is still further reduced by the removal of lung tissue and by interference with respiratory activity Further there is increased strain on cardiac activity owing to reduction of the vascular bed of the *lesser circulation with* resultant pulmonary hypertension This additional factor may be of considerable importance in the postoperative course *following pul*monary resection

In preoperative *care the* blood volume should be returned to normal This should

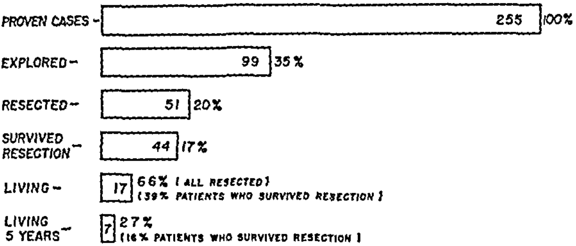


Fig 7 7 Experience at The New York Hospital over a 26-year period Only 2 7 per cent of total proved cases of lung cancer lived 5 years but 16 per cent of patients who survived resection lived 5 years

be maintained during and following operation The patient should be hydrated but not overhydrated The circulatory system of these elderly patients cannot stand abuse as readily as that of a younger person Shock on the one hand and circulatory overload on the other must be avoided The difficulties in successfully managing the serious complications due to deficiencies in the respiratory reserve are greater over the age of 60 years Adams finds that cardiorespiratory insufficiency as a cause of death is seen three times as frequently following pulmonary resection in patients over 60 years as in younger ones

TREATMENT

Surgery with complete extirpation of the tumor and regional lymph nodes has been found to be the only treatment which offers a cure in case the patient is able to undergo this procedure There are rare exceptions with long term survivals following the use of roentgen ray therapy or chemotherapy However Overholt in 51 patients who have

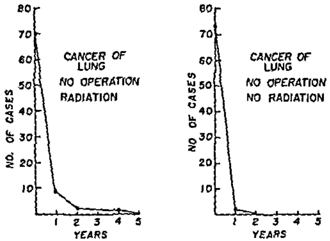


Fig 7 8 Mortality in cancer of the lung with no operation with and without radiation therapy With radiation therapy there is a marked mortality in the first year However all patients are not dead until the fifth year When patients receive no radiation all are dead by the second year

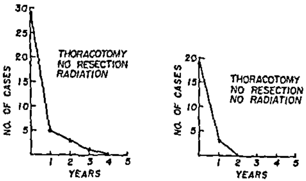


Fig 7 9 Death of patients with thoracotomy and no resection but with radiation therapy shows a marked decline in the first year and then falls more slowly In 4 years all patients are dead In those patients with thoracotomy no resection and no radiation the curve shows the same rapid drop in mortality in the first year However all patients are dead before the second year

survived cancer of the lung for 5 years finds that all had had pulmonary resection Not one single case treated by roentgen ray therapy or chemotherapy alone or in combination had lived 5 years

With this bleak picture Blades and Mc Corkle report a man 59 years of age who at operation was found to have an inoperable cancer of the lung Biopsy at operation confirmed the diagnosis of cancer Five years later the patient s chest films had cleared and although skull films showed a destructive lesion in the occipital bones he is reported as a case of spontaneous regression of an untreated bronchogenic carcinoma This man died in his sleep 7 or 8 years after the original operation He had worked the day before death and a complete examination 1 week before showed no cancer

Barnett et al report a 7-year survival after radiation therapy in a patient with inoperable cancer of the lung This patient, with a positive biopsy at bronchoscopy and inoperable at operation has now gone 14 years is still smoking 20 to 30 cigarettes a day and has very few symptoms

The so called *radical pneumonectomy* as a routine procedure has been advocated largely by Watson at Memorial Hospital His 5 year survival rate is about the same as other groups

Churchill long an advocate of lobectomy for carcinoma of the lung feels that this operation can be done with removal of all gross evidence of disease and should be done (1) where there is diminished pulmonary or cardiac reserve (2) where diagnosis is uncertain and the lesion can be totally excised (3) for small peripheral lesions with no involved lymph nodes and (4) where the lesion is beyond surgical bounds and the bulk of the primary tumor can be removed It should be pointed out that his lobectomy includes dissection of the anatomic unit, including adjacent lymph nodes His figures show that after 60 years of age lobectomy is used more often than it is before 60 He also finds no significant improvement in his survival statistics between the early and late groups when operative deaths are eliminated

In all series in which the tumor could not

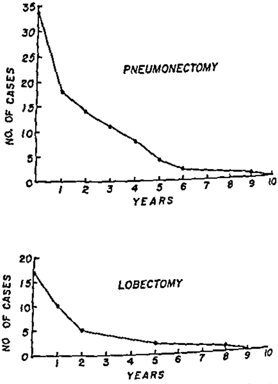


Fig 7 10 Pneumonectomy The curve shows a rapid drop in deaths the first year the curve then flattens and all patients are not dead until the tenth year Lobectomy The curve is still flatter from the beginning and all patients are not dead until the ninth year

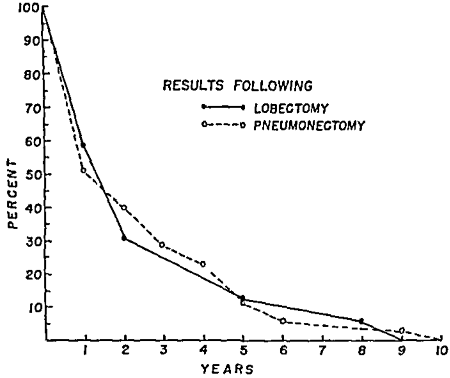


Fig 7 11 Survival following lobectomy and pneumonectomy changed into percentages The curves are almost superimposed

be removed there is very little change in the course of the disease and at the end of 1 year the vast majority of these patients are dead When the lesion is resected there is a very drastic mortality in the first year This then slows down and from 2 years on it approaches that of the general population

At The New York Hospital (1932 to 1958) there have been 255 proved cases of cancer of the lung in patients over 60 years of age (Fig 7 7) Of these 222 (87 per cent) were male and 33 (13 per cent) were female Exploratory thoracotomy was done in 99 (35 per cent) Resection was performed in 51 (20 per cent) In the 156 in which no operation was performed 143 were followed In the remaining 13 patients there has been no follow up

Radiation therapy either alone or in conjunction with surgery has been used in certain patients in all groups and shows better over all results There is an occasional case where its use has been followed by spectacular results

Almost all of the 156 patients in which no operation was carried out (Fig 7 8) died within 1 year Without radiation all were dead within 2 years With radiation all died within 5 years

Thoracotomy without resection of the tumor in 48 patients (Fig 7 9) shows almost identical results as without operation There were no deaths in this group showing that when properly evaluated and prepared patients over 60 with cancer of the lung withstand operation very well Without radiation no patient in this group lived 2 years and with radiation no patient lived 4 years

Results following lobectomy and pneumonectomy are almost identical both in respect to postoperative mortality and in respect to follow up (Figs 7 10 7 11) This can be accounted for on the one hand by the fact that lobectomies are done in the early cases and in patients with a small tumor on the one hand and on the other by the fact that lobectomy is used for the poor risk patient

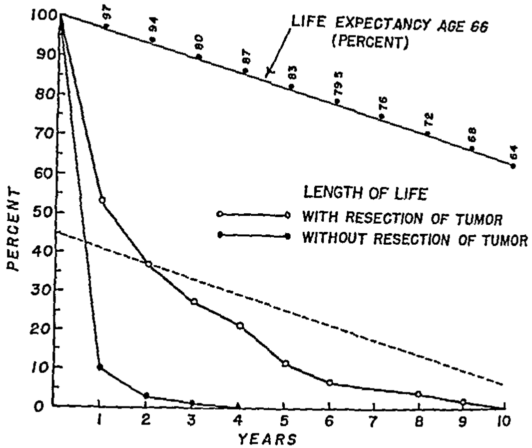


Fig 7 12 At age 66 the average person has a 64 per cent chance of living 10 years This is plotted against the curve of those patients who have had resection of the tumor and those without resection of the tumor With resection the curve drops rapidly for the first 2 years and then very nearly approaches that of the average life expectancy Without resection however the curve drops abruptly for the first year and levels out

Pneumonectomy was carried out in 34 patients with five deaths (11 7 per cent) There is a sharp fall in the curve for the first year then it flattens and at 5 years follows the life expectancy curve

Lobectomy was done in 17 patients with two deaths (12 5 per cent) There is a sharp fall in life span for 2 years then the curve follows the life expectancy curve

Figure 7 12 shows the life expectancy curve (in per cent) at age 66 which was the average age of the 255 patients All patients with resection of the tumor including all pneumonectomies and lobectomies are charted together Patients without resection of the tumor are charted together For the first 2 years the curves are similar showing a precipitous fall After 2 years they are similar to the life expectancy curve (Fig 7-13)

In breaking down the cases further considering positive and negative lymph nodes and also whether all tumor was removed or some left the cases became so few that the information was not helpful

CONCLUSIONS

It is readily apparent that if survival rates are to be improved patients must have adequate surgical excision while the disease is confined to the lung Since practically all these lesions produce an abnormality which can be detected radiologically the best method of discovering them is the wide spread use of roentgenography of the chest

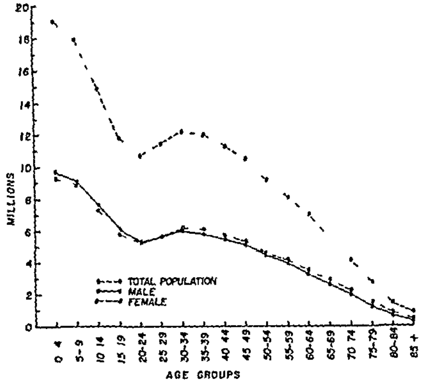


Fig 7 13 Total population and male and female age groups (1957) Notice that at age 25 these two lines cross

in the group of patients who are maximally susceptible to bronchogenic carcinoma that is men over 40 years of age who are heavy cigarette smokers The best method of diag nosing curable cases is surgical exploration The appearance of symptoms positive bron choscopic findings and positive results of sputum examinations seem to indicate an unfavorable but not hopeless situation

This form of management that is surgi cal exploration for otherwise undiagnosed abnormalities detected radiologically is hav ing an increased application at present be cause of the discovery of many coin lesions in radiologic surveys The basis of the plan of management remains early diagnosis and adequate early excision Many tumors of long duration will still be confined to the lung and will thus be potentially curable Treatment should not be withheld except for known extrathoracic disease and the inabil ity of the patient to tolerate the contemplated procedure

Elderly patients when properly evaluated and prepared tolerate operation surprisingly well and have a prognosis just as good as that of younger patients

BIBLIOGRAPHY

Adams W E Problems in Pulmonary Resec tion for Primary Lung Tumors in the Aged J Am Geriatrics Soc 2 440 1954

Auerbach O Gere J B Forman J B Petrick T G Smolin H J Muehsam G E Kassouny D Y and Stout A P Changes in the Bronchial Epithelium in Re lation to Smoking and Cancer of the Lung New England J Med 256 97 1957

Auerbach O Gere J B Pawlowski J M Muehsam G E Smolin H J and Stout A P Carcinoma in situ and Early Invasive Carcinoma Occurring in the Tracheobron chial Trees in Cases of Bronchial Carcinoma J Thoracic Surg 34 298 1957

Budinger J M Untreated Bronchogenic Car cinoma A Clinicopathological Study of 250 Autopsied Cases Cancer 11 106 1958

Campbell D C Jr and Langston H T Intrathoracic Surgical Procedures in Patients Past the Age of Sixty J Am Geriatrics Soc 3 330 1955

Churchill E D Sweet R H Scannell J G and Wilkins E W Jr Further Studies in the Surgical Management of Carcinoma of the Lung J Thoracic Surg 36 301 1958

Cole W H Operability in the Young and Aged Ann Surg 138 145 1953

Collier F C Blakemore W S Kyle R H Enterline, H T Kirby C K and Johnson J Carcinoma of the Lung Factors which Influence Five Year Survival with Special Reference to Blood Vessel Invasion Ann Surg 146 417 1957

Graham E A and Singer J J Successful Removal of an Entire Lung for Carcinoma of the Bronchus J A M A 101 1371 1933

Johnson J Kirby C K and Blakemore W S Should We Insist on Radical Pneumonectomy as a Routine Procedure in the Treatment of Carcinoma of the Lung? J Thoracic Surg 36 309 1958

Moore S W and Cole D R Primary Malignant Neoplasms of the Lung Ann Surg 141 457 1955

Overholt R H and Bougas J A Fifty one Cases of Lung Cancer with a Five year Survival J A M A 161 961 1956

Rigler L G A Roentgen Study of the Evolution of Carcinoma of the Lung J Thoracic Surg 34 283 1957

8

Cancer of the Esophagus

S W Moore

Carcinoma of the esophagus is a disease of the aged and is more prevalent as the human life span increases It is seen much more often in men than in women in a ratio of 5 1 However women develop the dis ease at a younger age than do men

The digestive tract is the site of 33 per cent of all cancers in the male This figure is somewhat higher in the white and some what lower in the nonwhite Cancer of the esophagus follows that of the stomach colon and rectum in frequency

The first successful resection of the thoracic portion of the esophagus for carcinoma was performed by Torek at the German Hospital now Lenox Hill in New York City on March 14 1913 The patient a woman of 67 years died 13 years later at age 80 of natural causes In this patient the esophagus was brought out through the neck and later connected to the stomach by means of a rubber tube

Despite the optimism engendered by Torek s success it was not until 1938 25 years later that Adams and Phemister reported the first successful resection of the esophagus in which the continuity of the gastrointestinal tract was reestablished Again the patient was a woman 53 years of age who had a squamous cell carcinoma of the terminal portion of the thoracic esoph agus The cancer extended into the abdomen and involved lymph nodes along the lesser curvature of the stomach After the tumor was excised the esophagus and stomach were joined This patient was free of evi dence of tumor 16 years following operation

Despite enthusiasm following these re ports there was a pessimistic attitude about surgical treatment of cancer of the esopha gus among surgeons interested in the care of these patients This may have been one of the greatest detriments to the progress of surgical treatment of this disease

In a series of over 1 000 cases reported by Ochsner and De Bakey in 1941 over 40 per cent showed no evidence of metas tases at autopsy They also collected reports of 195 resections for cancer of the esopha gus which revealed a mortality of over 70 per cent This can be contrasted with a re cent series in 1957 from one clinic (Naka yama) where 738 resections resulted in an operative mortality of 4 7 per cent

When reporting their cases many authors lump together those subjected to obviously palliative procedures with those having cura tive resections Other reports include adeno-carcinoma of the lower esophagus which in the large percentage of cases arises from the stomach and is an entirely different disease Still others include operative deaths in the end results This makes it difficult to inter pret the statistical data on the surgical treat ment of this disease

ETIOLOGY

Cancer of the esophagus appears to be more prevalent in certain parts of the world

It often occurs following trauma It is particularly common in China Japan, Russia and Scotland In China, more so in north China it is prevalent in areas where people are accustomed to take very hot food and drink Also *in north China*, the rougher drier forms of food are used and are physically more irritating Among the foreign born in this country who develop this condition it is most prevalent among the Russians In Scotland where the women drink excessively hot tea, cancer of the esophagus *is* reported to be more common among them than among men It is seen more often in the low income group, where the food is rough and bulky

Alcoholic beverages particularly those with a high alcohol content and those which have not been properly aged, have long been considered a factor in causing this disease Badly kept teeth oral sepsis and ill fitting dentures tend to cause hasty and incomplete mastication The food then contains large, hard particles which cause a certain amount of trauma and inflammation of the mucous membrane of the esophagus Passage of food is slowest at points of anatomic constriction, and the resulting trauma is greatest at these areas Cancer occurs more often at these sites than at others It has also been found often in patients with a history of swallowing lye, as well as in those who have had prolonged operative dilatation of the esophagus

ANATOMY

A number of anatomic factors increase the difficulty of effecting a surgical cure of cancer of the esophagus The organ is almost *wholly* enclosed in the chest, making it difficult both to examine and to approach surgically It is devoid of a serosal covering a layer which is so important in gastrointestinal anastomosis This lack of serosa contributes to poor healing of the suture line and consequent leakage of the anastomosis a major cause of death following operation There is a relative fixity and lack of redundancy in the esophagus *The blood supply is scarce* arising from the inferior thyroid artery and small branches from the aorta It courses side by side with other structures in the mediastinum sharing lymphatic trunks and nodes It lies in close relationship to the larynx, thyroid trachea, aortic arch left bronchus, pericardium, *descending aorta* both *mediastinal* pleurae, and diaphragm The lymphatic drainage is upward to the bronchial and tracheobronchial lymph nodes and downward to the nodes at the esophagocardiac junction

In using the stomach to replace the *esophagus in the chest it is essential to leave* the arterial arches along the greater and lesser curvatures completely untouched and to leave unligated either the right gastric artery along the lesser curvature or the right gastroepiploic artery along the greater curvature

PATHOLOGY

Squamous cell carcinoma is the most common primary malignant neoplasm of the esophagus *It occurs predominantly in males* and almost always occurs in individuals over 50 years of age the average being 65 years The site of the cancer is near points of natural narrowness of the esophagus, namely behind the cricoid bone the *bifurcation of* the trachea and the passage through the *diaphragm* Approximately 20 per cent of cases occur in the neck 10 per cent in the upper third 30 per cent at the bifurcation of the trachea and 30 per cent in the *lowest portion* of the esophagus This carcinoma starts as a *localized elevated plaque in the mucosa* which gradually enlarges in all directions largely by way of submucosal lymphatics It is slow growing but in a few months *to a year* can encircle the lumen when *it causes obstruction and with this a rapid* loss of weight In early stages the surface of the tumor is ulcerative with rolled up margins *owing* to the submucosal growth of the cancer *Extension* of the tumor to the surrounding *struc*

tures occurs in some 60 per cent of cases before death is caused by obstruction or complication

The direct spread is to the neighboring structures involving the mediastinum bronchus trachea lungs pleura, pericardium, heart and aorta This spread accounts for the complications of mediastinitis and perforation into the trachea bronchus lungs heart, or aorta with death by infection or hemorrhage

An important spread is in a longitudinal direction via the submucosal lymphatics with outcroppings at some distance from the palpable margin of the tumor when friable tumor emboli block lymphatic branches

In the cervical esophagus the spread is to the lymph nodes in the supraclavicular triangles From the thoracic portion metastases pass to the paraesophageal and tracheobronchial lymph nodes with downward extension to the subdiaphragmatic nodes along the lesser curvature of the stomach celiac axis and pancreas

Metastasis by blood stream is more common than most writers indicate At autopsy clumps of tumor cells are found in pulmonary vessels and metastases are found in the liver lungs and bones

The apparent high malignancy observed clinically is attributable in great measure to the obstructive character of the lesion involving as it frequently does a narrow portion of the esophagus and thus giving rise to early starvation

SYMPTOMS

At first cancer of the esophagus causes no symptoms A very unusual patient may die as a result of this disease and come to autopsy still without symptoms referable to the esophagus In others all symptoms may be due to metastases or extensions of the cancer and their complications

Symptoms include vague complaints of substernal pressure or feeling of obstruction difficulty in breathing heartburn increased mucus foul breath, a feeling of discomfort in the neck and substernal pain on swallowing hot liquids

Usually the only early symptom is dysphagia which is also the most common occurring in 75 to 95 per cent of patients with cancer of the esophagus Starting first with meat or dry bread it progresses until the patient cannot swallow liquids Unfortunately this is a late symptom and occurs only when the esophagus is encircled by tumor However dysphagia is not an infallible diagnostic symptom and may be present for many years as a result of other conditions Patients are also treated for months or years for peptic esophagitis or cardiospasm only to find cancer either too late to cure it or at autopsy

Hoarseness voice changes vocal cord paralysis hiccups backache, pain, cervical metastases weakness epigastric discomfort mediastinitis empyema and tracheoesophageal fistula all are late symptoms Perforation into the aorta is quickly fatal

Despite the feeling of some that the duration of symptoms bears no relationship to operability the shorter this is the greater is the chance of cure Unfortunately, dysphagia is present for an average of 6 months before the patient or the physician does anything about it

Weight loss occurs in all patients with the onset of obstruction and varies from very little to as much as 100 lb

DIAGNOSIS

An education campaign should be directed toward both the medical profession and the laity to acquaint them with the fact that carcinoma of the esophagus is no longer a hopeless disease and to counteract the pessimistic reports which have appeared in the medical literature An awareness of the early symptoms and prompt action will do much to establish a definite diagnosis early

It is unfortunate that diagnostic tests are expensive time consuming and uncomfort

able, making delay on the part of both patient and physician understandable. In addition, none of the tests is infallible particularly in ruling out early carcinoma of the esophagus.

Roentgen ray Examination

Until half the circumference of the lumen has been involved, barium may pass the esophagus without hindrance. For vague complaints frequently only the stomach and duodenum are examined and the esophagus omitted. The esophogram still remains our primary diagnostic method, but we must remember that it does fail to detect some lesions and that it is in the small early cancer that this examination will give the poorest results. The distal portion of the esophagus offers particular difficulties in examination to the roentgenologist.

In a study of well persons in which an esophogram was done in every individual over the age of 40 Watson found one tumor in a large number examined. This patient's growth was resectable, and she remained well for 11 years. It was felt, however, that such investigation was too expensive and time-consuming to be practicable.

Esophagoscopy

Esophagoscopy is most important in establishing a microscopic diagnosis by biopsy and Papanicolaou smear, particularly in the early cases and frequently establishes the diagnosis when the esophogram is normal. Esophagoscopy should be done more often, particularly when symptoms persist or are not explained. The dangers of esophagoscopy are not great, and a repeat examination may be necessary for a positive diagnosis. It is important to get a lateral film of the neck first in order to rule out arthritic spurs which may cause a perforation of the esophagus on esophagoscopy.

Papanicolaou Smear

This offers tremendous promise as a simple, nonpainful and comparatively inexpensive way to establish an early diagnosis. It requires expert help not only to read the slides but to obtain the specimen. One is useless without the other. A Levin tube is swallowed to secure esophageal washings of saline. These washings are obtained from various locations, particularly just below the level of the suspected lesion, which lies just a few inches below the point where the patient indicates externally that the food seems to stick. It is best not to attempt washings for 24 to 48 hours after barium examination. By this method it is almost impossible to differentiate between adenocarcinoma of the lower esophagus and the cardia of the stomach. Washings obtained by means of the Levin tube give more accurate results than those obtained by esophagoscopy. Ninety per cent of actual cases of cancer of the esophagus give positive results. There are few false negatives and there should be no false positives. There will be some doubtful cases.

These three tests should be used together and early persistent efforts will be rewarded by diagnosis of curable cases. The surgeon should utilize every available method to establish a positive histologic diagnosis.

TREATMENT

Carcinoma of the esophagus can be cured by two methods. (1) Surgery is indicated when the entire cancer is localized in the esophagus and lymph nodes. When the tumor is completely excised the patient is cured. (2) Irradiation may be used under certain conditions and with this method it may also be possible to sterilize the area and kill all cancer cells. Unfortunately the salvage by either of these methods at present is low.

In discussing treatment it is necessary to divide the esophagus into four areas. (1) the neck or cervical. (2) the upper thoracic esophagus above the aortic arch. (3) the midthoracic portion behind the aortic arch. (4) the lower thoracic esophagus just above the diaphragm.

Surgery

As pointed out under pathology this tumor spreads by the submucosal lymphatics and tends to encircle the esophagus It also extends laterally into the lymphatics lymph nodes about the trachea bronchi and neck and abdomen In addition it spreads in a longitudinal manner up and down the esophagus at times coming to the surface as a nodule of cancer These factors call for wide excision of the organ but owing to the proximity of extremely important organs this is difficult There is also the problem of replacing the esophagus It is clear that save in the lowermost tumors, almost all the thoracic esophagus should be removed

At present the esophagus is replaced in the neck by the use of skin flaps to make a new tube In the chest the stomach can be brought up and joined to the esophagus A portion of the jejunum or colon may also be used to replace the excised esophagus These can be brought up in a tunnel under the skin anterior to the sternum through the mediastinum back of the sternum or else brought through one of the thoracic cavities

In order to cure this cancer it is necessary to excise radically all gross evidence of the disease Some surgeons are willing to remove the primary tumor for palliative purposes even though some tumor must remain However when tumor is transected when there are distant metastases in the lungs or liver when the recurrent nerve is involved, when the cancer extends into the heart aorta trachea or bronchus when the growth is implanted into the pelvis or the pleura presently available surgical techniques will not cure the condition

Any series of cases reported prior to 1946 is useful largely for historical interest as far as operative mortality and cure rate are concerned It is since this time that major strides have been made in treatment of this cancer In 1955 Adams and Phemister reported resection of 40 tumors with a mortality of 12 5 per cent In the 35 patients who survived the operation 9 lived for 5 years or longer 1 each for 16 years 11 years 10 years, and 8 years and 5 for 5 years This gave an over all 5 year survival for all resections of 22 5 per cent In 1954 Garlock and Klein reported a 5 year survival rate excluding operative mortality of 47 2 per cent

It is well to remember that unless something can be done these patients will live less than 1 year The operative mortality is steadily becoming lower and Nakayama (1957) has resected 738 cases with a mortality rate of 4 7 per cent His mortality when the upper and middle thoracic esophagus was removed was 9 4 per cent in 213 cases In 526 cases involving the lower esophagus and cardia of the stomach there were only 15 deaths a mortality of 2 9 per cent

Cervical Esophagus

Operation for carcinoma in the cervical esophagus is best done for early localized lesions When the cancer has escaped the lymph nodes, operative procedures are of little help

Upper Thoracic Esophagus

Only 10 per cent of esophageal cancers occur here but the difficulties of operation are increased The tumor spreads quickly to the lymph nodes in the neck Anastomosis must be done in the neck and the section of esophagus to be replaced is longer This group has the poorest prognosis

Midthoracic Esophagus

This cancer accounts for 30 per cent of lesions Lying behind the aorta it spreads quickly to the neighboring lymph nodes as well as by direct extension into nearby structures The anastomosis must be done above the aorta or in the neck This cancer may be approached through the left chest but it is preferable to attack it from the right Nakayama has reported 22 cases of radical esophagectomies for upper and middle thoracic esophageal cancers without an opera-

tive death Sweet reports a 5 year survival rate after resection of 14 per cent for carcinoma of the midesophagus

Lower Thoracic Esophagus

It is well to separate adenocarcinoma from squamous carcinoma Squamous cell carcinoma at this site accounts for 30 per cent of the lesions Adenocarcinoma is not amenable to irradiation and is usually bulky, giving rise to symptoms earlier but yielding better results from surgery It is in this group that operation is easiest A wider resection can be carried out, and the section of esophagus to be replaced is shorter There is a temptation to do the anastomosis below the arch of the aorta and the cancer may have spread upward in the esophagus above the line of resection Because of this longitudinal spread 10 cm of esophagus should be removed above the gross lesion, and this usually means an anastomosis above the aortic arch It is in this group that the best results are obtained

Complications of Surgery

No patient should be rejected because of age alone Each patient must be assessed These patients are usually thin but in good physical condition The cardiovascular and pulmonary status must be carefully evaluated Leakage of the anastomosis causes half the deaths following operation Cardiac and pulmonary complications including pulmonary embolus, cause almost all the others It is well to ligate any thoracic duct which is divided in order to prevent chylothorax

Irradiation

With the marked improvement in surgical treatment of carcinoma of the esophagus, there has been a similar improvement in irradiation technique, and it is not always clear which is preferable It is certain that irradiation can cure primary carcinoma of the esophagus but not all tumors are sensitive to this treatment Many radiologists believe that the over all survival and palliation rate could be much improved if patients with squamous cell carcinoma of the esophagus were treated primarily by adequate irradiation without preliminary thoracotomy However extension into lymph nodes is not well controlled and there are also complications involved in irradiation, including perforation of the esophagus The minimal tumor dose is 5,000 r delivered in 35 to 40 days which is near the limits of tolerance for the esophagus Postoperative irradiation is used by many who feel that it improves the surgical result For best results for the patient both forms of treatment must be used and each fitted to the individual needs

Palliation

It is not clear just how much can and should be done in the way of palliation in patients with cancer of the esophagus It is difficult to watch a patient starve to death with complete obstruction of the esophagus and to do nothing It has been shown over and over that gastrostomy or jejunostomy prolong survival only a few months and that many of these patients are never able to leave the hospital If a Levin tube can be passed it will give just as much relief

There have been numerous attempts to place a prosthesis in the obstruction and to keep a passage clear Souttar devised a tube formed of German silver wire which he passed through an esophagoscope Mackler, through a thoracotomy incision incised the esophagus above the lesion and through this area passed a tube which he held in place by a circular suture Many tubes of nylon and other plastic material have been devised These all permit feeding but the survival time is 4 to 6 months

Most surgeons feel that if the primary growth can be removed and an anastomosis performed, even though tumor is left behind this should be carried out unless tumor must be cut across to carry out this procedure

There is no question that here irradiation helps a great deal At times it can control the original lesion and allow the esophagus to open up It will also increase the survival time and, in certain cases there is a remarkable improvement

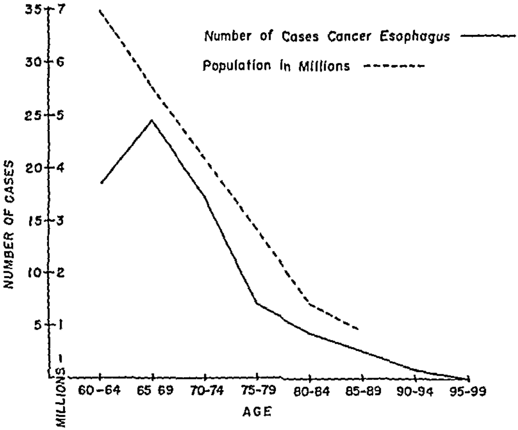


Fig 8 1 Incidence of cancer of the esophagus quickly reaches a peak at 65 to 69 years and then falls in direct proportion to the aging population In other words the incidence of cancer of the esophagus remains constant as the age increases

THE NEW YORK HOSPITAL EXPERIENCE

From 1932 to 1959 there were 71 patients over 60 years of age admitted to The New York Hospital with carcinoma of the esophagus It must be pointed out that of 22 resections all save 1 this done in 1944 were carried out after 1946 There were 66 males and 5 females The number of patients quickly reached a peak at 65 to 69 years and then fell off in direct proportion to the number of that age group in the population (Fig 8 1) All treated patients were followed

Duration of Symptoms

In eight patients symptoms had been present for less than 1 month This number increased until 6 months then fell until 10 months was reached They were then scattered until finally the last patient had had symptoms for 4 years

Level of Lesion

There were no lesions of the cervical esophagus there were 13 in the upper 33 in the middle and 35 in the lower thoracic esophagus All were squamous cell carcinoma Adenocarcinoma of the lower esophagus or of the cardia of the stomach are not included

Radiation Therapy Alone

There were 17 patients who were not operated upon and received only radiation therapy However not all of these finished the complete course of therapy The majority were dead in 1 year One patient survived 3 years but none lived as long as 4 years (Fig 8 2)

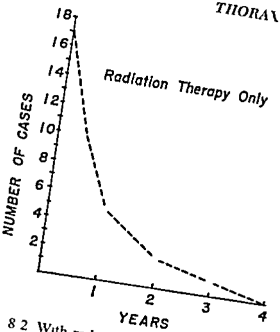


Fig 8 2 With radiation therapy alone the majority of patients with cancer of the esophagus were dead before 1 year and none lived 4 years This group consisted of those with the most advanced cancer

Exploration—No Resection

Of 8 patients explored but not resected and given no radiation none lived as long as 7 months In this same group, 13 patients were given radiation therapy, and there was a marked improvement in the results, 4 lived 1 year but none as long as 2 years (Fig 8 3)

Figures 8 2 and 8 3 very clearly indicat the usefulness of irradiation in prolongin life

Resection

Twenty two patients had the tumor resected, and 10 of these died in the hospital These 10 are counted as postoperative deaths although 2 occurred after 30 days The operative mortality was 45 4 per cent Curative resections were done on 10 patients, with five deaths a mortality of 50 per cent Curative resections include patients in which the operator felt he had removed all gr--

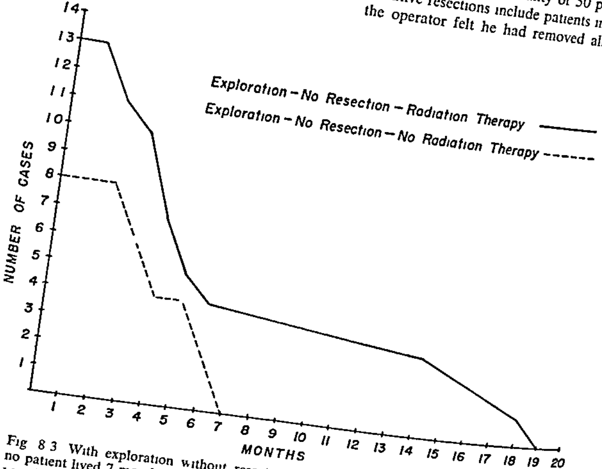


Fig 8 3 With exploration without resection or radiation in cancer of the esophagus no patient lived 7 months When radiation was used one third of the patients lived one year but none as long as 2 years

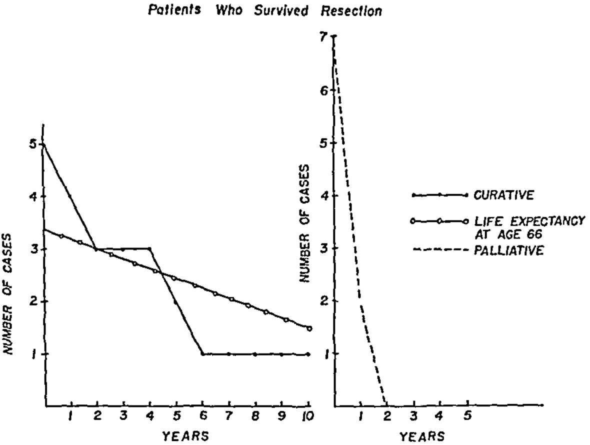


Fig 8-4 In cancer of the esophagus with palliative resection no patient lived 2 years With curative resection 40 per cent lived 5 years 20 per cent lived 10 years

tumor This also includes patients in whom nodes removed at operation contained cancer

Palliative resections were done on 12 patients with five deaths a mortality of 42 per cent None of the 7 patients who survived a palliative resection lived 2 years (Fig 8 4) Of the patients who survived a curative resection 2 survived 5 years (40 per cent) and 1 survived 10 years (20 per cent) (Fig 8 4) Both these patients are alive and well Another patient is alive and well 1 year after curative resection Thus of 5 patients who survived a curative resection 60 per cent are alive and well One of these patients received postoperative irradiation The other 2 received no irradiation Following resection there is a rapid decline in the number of patients who survive for 2 years the curve then is almost identical with the life expectancy curve at age 66 (Fig 8 5)

When the survival curves of all patients are plotted together it is seen that for the first 2 years they are very similar and show a rapid decline None of those who received irradiation alone lived as long as 4 years Nine per cent of those resected lived 5 years and 17 per cent of those who survived the operation lived 5 years (Fig 8 6)

The complete story is told in Fig 8 7 Of 71 patients 68 per cent were explored 30 per cent were resected 17 per cent survived resection and 3 per cent were alive 5 years after resection

SUMMARY

Cancer of the esophagus after a period of growth with few minor symptoms during which it encircles the esophagus proceeds rapidly to cause death from starvation At autopsy 40 per cent show only a local growth

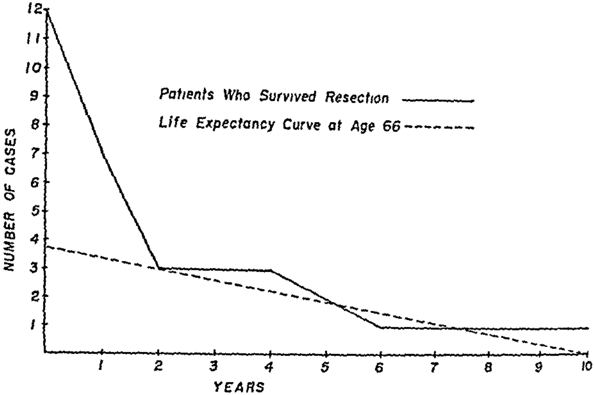


Fig 8 5 Following resection for cancer of the esophagus most deaths occur within the first 2 years This includes all palliative resections The survival rate then follows closely the life expectancy curve at age 66

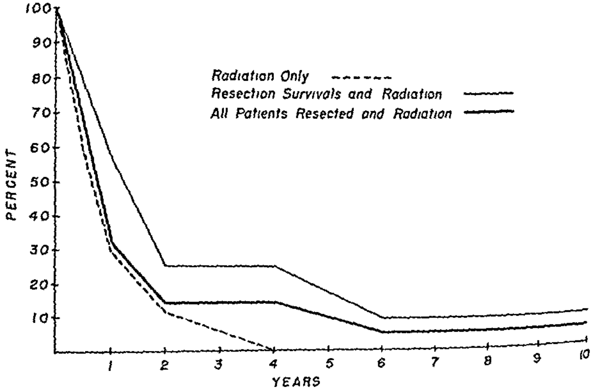


Fig 8 6 When all groups of cases with cancer of the esophagus are compared for the first 2 years they show the same high mortality No patient treated by irradiation alone lived 4 years In the group which survived resection 17 per cent survived 5 years In the curative resections shown in Fig 8 4 40 per cent survived 5 years

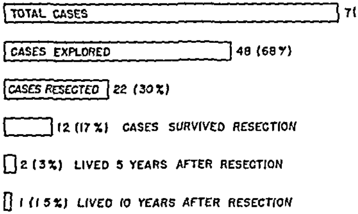


Fig 8 7 Summary of the results in 71 patients over age 60 with carcinoma of the esophagus This is not entirely accurate as 3 patients are alive and well 1 of whom had his operation less than 5 years ago

and no evidence of distant spread These cases can be cured by surgery To accomplish this calls for almost total excision of the esophagus in most cases Today adequate methods are available to replace this organ The surgical mortality is rapidly diminishing and long term survivals constantly increasing

BIBLIOGRAPHY

Adams W E The Future Outlook of Surgical Therapy for Carcinoma of the Esophagus Surg Gynec & Obst 100 366 1955

Adams W E and Phemister D B Carcinoma of the Lower Thoracic Esophagus—Report of a Successful Resection and Esophagogastrostomy J Thoracic Surg 7 621 1937–1938

Burnett H W Jr and Moore S W Squamous Cell Carcinoma of the Thoracic Esophagus Am J Roentgenol 76 949 1956

Buschke F Surgical and Radiological Results in the Treatment of Esophageal Carcinoma Am J Roentgenol 71 9 1954

Ellis F H Jackson R C Krueger J T Jr Moersch H J Clagett O T and Gage R I Carcinoma of the Esophagus and Cardia Results of Treatment—1946–1956 New England J Med 260 351 1959

Garlock J H and Klein S H The Surgical Treatment of Carcinoma of the Esophagus and Cardia Ann Surg 139 19 1954

Gephart T and Graham R M The Cellular Detection of Carcinoma of the Esophagus Surg Gynec & Obst 108 75 1959

Mustard R A Selection of Therapy for Esophageal Cancer A M A Arch Surg 75 674 1957

Mustard R A and Ibberson O Carcinoma of the Esophagus A Review of 381 Cases Admitted to Toronto General Hospital 1937–1953 Inclusive Ann Surg 144 927 1956

Nakayama K Approach to Mid thoracic Esophageal Carcinoma for Its Radical Surgical Treatment Surgery 35 574 1954

Nakayama K Statistical Revue of Five year Survivals after Surgery for Carcinoma of the Esophagus and Cardiac Portion of the Stomach Surgery 45 883 1959

Nakayama K and Yanagisawa F Total Experience with Carcinoma of the Esophagus and Cardia of the Stomach Chirurg 28 241 1957

Ochsner A and De Bakey M Surgical Aspects of Carcinoma of the Esophagus J Thoracic Surg 10 401–445 1940–1941

Sweet R H The Results of Radical Surgical Extirpation in the Treatment of Carcinoma of the Esophagus and Cardia with Five year Survival Statistics Surg Gynec & Obst 94 46 1952

Sweet R H Late Results of Surgical Treatment of Carcinoma of the Esophagus J A M A 155 422 1954

Torek F The First Successful Resection of the Thoracic Portion of the Esophagus for Carcinoma J A M A 60 1533 1913

Watson W L and Goodner J T Carcinoma of the Esophagus Am J Surg 93 259 1957

Wookey H The Surgical Treatment of Carcinoma of the Pharynx and Upper Esophagus Surg Gynec & Obst 75 499 1942

9

Cardiospasm

William A Barnes

Cardiospasm achalasia megaesophagus, esophagectasia phrenospasm and dolichoesophagus are some of the terms used to describe idiopathic dilatation of the esophagus without anatomic stenosis The choice of nomenclature varies with the individual concept of the pathologic physiology of the condition

The term *cardiospasm* has been used for many years to designate this disorder because it was attributed to spasm in the region of the cardia Following the observation that there was degeneration of Auerbach s plexus in the wall of the esophagus associated with inadequate muscular contractions of that organ the term *achalasia* (failure to relax) was proposed and has become popular

While diminution in the number of ganglion cells in the muscular wall of the esophagus has been described in this condition this has not been found universally In some cases apparently active ganglion cells are present in the lower segment of the esophagus while they are absent or reduced in number in the thickened upper portion It may be that degeneration of ganglion cells occurs exclusively or to a greater degree above the lowermost segment Although the factors responsible for relaxation of the lower segment of the esophagus are not established it may be theorized that some abnormality of the neuromuscular mechanism prevents the usual impulses for relaxation from reaching the distal segment with resultant cardiospasm or achalasia

Other possible causes of cardiospasm have been proposed including the effect of external mechanical factors, such as pressure about the lower esophagus from the aorta and diaphragm and periesophageal and intraesophageal inflammatory changes in that region

It has been suggested that two separate entities constitute the disease One, *functional cardiospasm*, or achalasia occurs with little or no significant dilatation of the esophagus the other and more common type *megaesophagus* is associated with conspicuous dilatation of the viscus However this dual concept is not universally accepted and since the etiology of the condition remains obscure we shall consider under one term *cardiospasm* this disorder that has the characteristics described below

INCIDENCE

It has been stated that among all admissions to a large general hospital cardiospasm occurs in 0 05 per cent of cases There is no conspicuous predominance of either sex although in some series females are more numerous Most cases become manifest clinically in the third and fourth decades but cardiospasm has been found not infrequently in infancy and childhood and the first symptoms and sign of the condition have been noted in a man in his eighty seventh year[1] There is no familial or hereditary tendency

TABLE 9-1 AGE AND SEX OF 30 PATIENTS OPERATED ON FOR CARDIOSPASM *

	Age yr					
	10 20	1 31	31–41	41 50	51 60	61 0
Females ( )	0	6	4	1		4
Males (8)	1	1		1	[illegible]	1

* The New York Hospital Corn ll Med al C ter eries

While symptoms apparently can be ag gravated by tensions and emotional upsets there is little evidence to support the belief that psychic factors are important in the development of cardiospasm

Among a series of 30 patients subjected to operation for cardiospasm at the New York Hospital there were 22 females and 8 males They varied in age from 19 to 64 years at the time of operation with the few est (2) operated upon in the fifth decade (Table 9 1) Almost half the patients (14 out of 30) were over 50 years of age

Symptoms had been present for from a few months to as long as 30 years before operation Among those over 50 years of age four had had symptoms for 15 to 37 years

DIAGNOSIS

The diagnosis of cardiospasm is made on the basis of the *symptomatology* findings on *x ray examination* and *physiologic* tests

SYMPTOMATOLOGY

The cardinal symptoms of cardiospasm are dysphagia epigastric or lower chest dis comfort or pain and regurgitation Malnu trition may occur but hemorrhage is un common

Dysphagia characterized by the sensation of obstruction to the passage of ingested ma terial near the level of the xiphoid may vary considerably in degree At least in the early stages it may be intermittent Occasionally the sensation of obstruction may be referred to a higher level in the esophagus Patients volunteer the information that dysphagia is often associated with tension or emotional stress Cold foods are more apt to produce symptoms than those of moderate tempera tures As much difficulty may be encoun tered with fluids as with solids This is in contrast to dysphagia associated with or ganic obstruction (e g carcinoma or be nign stricture) where liquids pass with rela tive ease at least until a comparatively ad vanced stage of the disease

The mechanism of dysphagia in cardio spasm is due to a motor disturbance with failure of propagation of the normal peri staltic wave down the esophagus and to fail ure of relaxation of the vestibule (esophago gastric sphincter) Since normal contrac tions do not propel the food distally, the pa tient often uses gravity and various maneu vers to help pass ingested material into the stomach He may stand while eating and by straining attempt to force the passage by altering the intrathoracic pressure

Pain in the lower substernal region is a frequent accompaniment of cardiospasm Although it is sometimes spontaneous it is most often brought on by attempts at de glutition In advanced cases esophagitis contributes to its occurrence

Regurgitation is common and is of par ticular importance in the older age group It frequently happens during sleep when aspiration can result in pneumonia Recur rent aspiration of esophageal contents can result in chronic pneumonitis of serious de gree (Fig 9 1)

Patients may resort to self induced re gurgitation to eliminate material retained in the esophagus

Malnutrition is a common finding in ad vanced cases of cardiospasm although pa tients with symptoms of many years dura tion often maintain a normal nutritional status Although it has been suggested that deficiency of thiamine hydrochloride may play a role in the development of cardio spasm obvious vitamin deficiencies are un



A



B

common and the disorder affects people of all economic classes

Hemorrhage from the esophagus is infrequent in patients with cardiospasm even in advanced stages With fermentation of retained food the mucosa of the esophagus becomes the seat of inflammatory changes Superficial erosions associated with this esophagitis found in advanced cases can result in blood streaking of regurgitated material

X RAY EXAMINATION

While x ray examination of the barium containing esophagus is a most useful diagnostic aid in the early stages of cardiospasm little change from normal may be evident The primary peristaltic wave stops in the upper part of the esophagus and ineffectual activity is observed in the body Dilatation of the organ is often absent and because of the intermittent nature of the functional obstruction in the lower esophagus delay in emptying may not be observed It is in such cases that studies of the physiologic alterations in the esophagus (described below) suggest the diagnosis However in the usual case the findings on x ray examination are characteristic There is slight to conspicuous dilatation of the esophagus and motility of the wall is diminished or absent In no other condition does the organ reach larger proportions (Fig 9 1) The smooth conical or beaklike narrowing of the terminal esophagus is almost pathognomonic (Fig 9 2*A*) and is usually readily differentiated from narrowing associated with organic

Fig 9 1 *A* Cardiospasm Esophagram of a 61 year old male with dysphagia of 8 years duration and dyspnea for 1½ years Conspicuous dilatation of the esophagus with smooth abrupt narrowing near the diaphragm is evident (N Y H No 530337) *B* Roentgenogram of chest of patient shown in Fig 9 1*A* Note the large esophagus in the upper mediastinum and the marked pulmonary changes especially in the lower left lung field that resulted from numerous attacks of aspiration pneumonia over the years



Fig 9 2 *A* Cardiospasm of moderate degree Esophagram before operation showing failure of barium suspension to enter the stomach 30 minutes after ingestion (N Y H No 245435) *B* Esophagram of patient shown in Fig 9 2*A* after Heller myotomy procedure There is prompt passage of barium suspension into the stomach and reduction in the size of the esophagus

stricture or carcinoma The passage of the contrast agent into the stomach may be delayed for hours In the late or decompensated stage only gravity and changes in intrathoracic pressure are at work to propel ingested material into the stomach

PATHOLOGIC PHYSIOLOGY

During the past several years studies of the motility of the esophagus during deglutition have aided in the differential diagnosis of certain disorders of that organ In cardiospasm there is failure of the vestibule (esophagogastric sphincter) to relax upon deglutition with rise in pressure in the segment to a very high level e g 100 cm of water that may last for as long as 15 minutes The body of the organ also demonstrates disturbed motility with failure of peristaltic progression to ensue with swallowing and with delayed emptying (Fig 9 3*B*) A marked contraction of the esophagus that follows the injection of a cholinergic agent Mecholyl is a characteristic finding in patients with cardiospasm and has not been noted in normal patients or in those with other lesions of the esophagus This effect may serve to establish the diagnosis in doubtful cases and can be demonstrated best by expulsion of air from a balloon inserted within the esophagus The conspicuous response to Mecholyl is probably due to derangement of the intrinsic nerve plexuses following Cannon s law of denervation

DIFFERENTIAL DIAGNOSIS

Among conditions to be considered in the differential diagnosis of cardiospasm are malignant and benign neoplasms hiatus hernia benign stricture scleroderma lower esophageal ring diffuse and localized spasm and psychic disturbances of deglutition (Table 9 2)

Carcinoma involving the esophagus is the first diagnosis to be considered in an elderly person with recent symptoms of dysphagia Carcinoma at the esophagogastric junction can closely simulate cardiospasm in symp

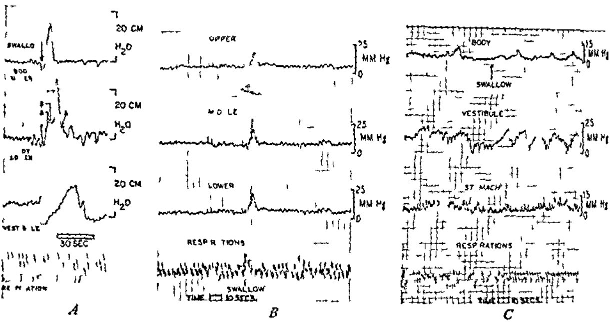


Fig 9 3 Pressure changes in the esophagus with swallowing (*From W A Barnes and M H Sleisenger Physiological Considerations in the Surgical Management of Disorders of the Esophagus S Clin North America 38 331 1958*) *A* Normal Motility of normal esophagus after swallow of 10 cc of water recorded by open tipped catheters and electromanometers *Note progress of peristaltic wave (4) in body and different moto* pattern of vestibule (esophagogastric sphincter) 1 Inspiratory effect 2 transmitted *pressure from pharynx* 3 plateau 4 peristalsis 5 respiratory effect (*J H Pert M Davidson and M H Sleisenger Unpublished data*) *B* Cardiospasm Note that the rise *in pressure occurs simultaneously* at all sites in the body in contrast to *progression from* above downward as in the normal C Scleroderma The normal swallowing complex in the body of the organ is not seen

tomatology and laboratory findings As previously indicated in cardiospasm dysphagia is often as marked with liquids as with solids whereas with organic (e g neoplastic) *in*volvement of the esophagus difficulty is encountered earlier and more definitely with solids

Carcinoma of the esophagus is more readily differentiated from cardiospasm than is carcinoma of the cardia of the stomach On radiographic examination the former evinces an irregular narrowing in the esophagus that is usually readily seen and biopsied through the esophagoscope Carcinoma arising in the cardia often extends into the submucosa of the esophagus producing on x ray examination a smooth narrowing mimicking the beak-like narrowing of cardiospasm To the esophagoscopist it presents a normal appearing mucosa lined esophagogastric junction biopsy of which may fail to show malignant tissue However the suspicion of neoplasm is aroused by fixation in the region of the esophagogastric junction as well as by failure readily to introduce sizable bougies into the stomach *Also of aid in the diagnosis is* cytologic examination of material from the esophagus or stomach

Benign neoplasm of the esophagus is uncommonly associated with dysphagia Occasionally a lipoma near the esophagogastric junction simulates cardiospasm on radiographic studies and may not be identified positively on esophagoscopic examination The benign tumors usually present on x ray examination as a *smooth indentation* into the lumen with a normal overlying mucosal pattern

Hiatus hernia is more common in the older age group than in the younger and this condition is more often to be differentiated from cardiospasm among elderly persons Both the paraesophageal and the much more frequent sliding type of hiatus hernia may be

Table 9.2 Differential Diagnosis of Cardiospasm

	Cardiospasm	Neoplasm: Malignant	Neoplasm: Benign	Hiatus hernia (sliding)	Scleroderma	Diffuse spasm
Age	Young to middle age	Older	Any age	Older	Middle age	
Sex (predominant)	Neither	Male	Neither	Female	Female	Female
Symptoms: Dysphagia	Intermittent. Early	Progressive	Intermittent if present	Intermittent. Persistent with stricture	Persistent	Very variable
Obstruction	Equal difficulty with liquids and solids	Especially solids	Especially solids	Especially solids	Especially solids	Equal difficulty with liquids and solids
Pain: Type	With deglutition	Constant, late	No	Burning with esophagitis	Burning with esophagitis	Striking symptom
Site	Substernal	Often in back		Substernal	Substernal	Substernal with radiation to neck, back and head
Regurgitation	Frequent from esophagus	Late in course	Rarely	Frequent from stomach	Occasionally	Variable
Heartburn	No	No	No	Characteristic	Occasionally	No
X-ray studies: Fluoroscopy	Atonic wall	Normal activity	Normal activity	Normal activity	Abnormal peristalsis. Decreased tone	Hyperactive
Size	May be large	Slightly to moderately enlarged	Usually normal	Usually normal	Narrow distally	No dilatation
Shape	Diffuse dilatation with bird beak distally	Dilatation above obstruction. Irregular at lesion	Normal, or smooth bulge of tumor	May appear short. Gastric folds above diaphragm	May have several areas of narrowing	Diffuse narrowing. Irregular spasm. Pseudodiverticula
Retention	Characteristic	Late in course	Usually no	Occasionally but usually with stricture	Late in course	No
Esophagoscopic examination: Mucosa	Superficial esophagitis from retention is marked	Irregular friable tissue	Normal over bulge of tumor	Often esophagitis of varying degree	Atrophic	Normal
Pliability of wall	Normal in early cases	Fixed in region of lesion	Pliable except at tumor	Normal unless fibrosis occurs	Thickened and rigid wall	Not involved organically
Physiological studies: Peristalsis	Diminished absent	N[illegible] at lesion	Normal except possibly at lesion	Normal	Diminished	Hyperactive
Response to Mecholyl	Exaggerated spasm of body	No response	No response	No response	No response	No response
Course	Progresses over years	Progressive over months	Stationary for months or years	Slowly progressive with esophagitis	Slowly progressive at times	Persistent
Other points		Cannot be relieved by drugs except narcotics		Symptoms provoked by reclining, relieved by sitting and standing	Raynaud's phenomenon often present	Often associated with other lesions of alimentary tract



Fig 9 4 Scleroderma Esophagram with apparent rigidity of the wall of the esophagus slight dilatation and delay in emptying (N Y H No 373615)

associated with dysphagia With the sliding type there is usually a history of heart burn and symptoms suggesting gastroesophageal reflux (see Chap 10 section on Hiatus Hernia) There is no retention in the esophagus on x ray examination and the herniated segment of stomach can usually be demonstrated Regurgitation if it occurs is of gastric rather than of esophageal contents

Scleroderma more often presents difficulty in differentiation from sliding hiatus hernia with esophagitis and stricture but it may mimic cardiospasm (Fig 9 4) Characteristic Raynaud s phenomena are usually present when scleroderma involves the esophagus although the abnormalities in the esophagus can precede the skin changes

Diffuse spasm of the esophagus of unknown etiology is usually intermittent and painful Confusion with early cardiospasm is common There is variable dysphagia influenced by emotional factors Pain the most prominent symptom is usually substernal but sometimes radiates to the neck or head X ray examination shows involvement of the lower half of the esophagus with irregular spasm diffuse narrowing or multiple pseudodiverticula (Fig 9 5) There is hypermotility with high pressures and simultaneous contractions in different segments of the esophagus associated with the act of swallowing This is in contrast to the findings in cardiospasm Response to Mecholyl is absent with diffuse spasm

CLINICAL COURSE

It is surprising to see the huge dilatation of the esophagus that numerous patients acquire and often tolerate during a period of many years while the symptoms of cardiospasm gradually progress Yet in others the observable changes in the organ are much less conspicuous, although symptoms may grow in severity The rate of increase of symptoms does not seem to be related to the age of the patient However as with other conditions the elderly patient is less able to tolerate the effects of the complications that may develop In addition to malnutrition and even cachexia that result from diminished food assimilation the most serious problem encountered in the aged is pulmo



Fig 9 5 Curling of the esophagus The cause of this irregular spasm is unknown (N Y H No 75641)

nary infection Regurgitation and aspiration into the tracheobronchial tree may be associated with acute changes (pneumonia lung abscess) or with more chronic pulmonary disorders, such as chronic pneumonitis lipoid pneumonia and pulmonary fibrosis (Fig 9 1B) Unless recurrent aspiration is prevented by relieving the stasis in the esophagus irreversible pulmonary changes and death follow In some cases even should regurgitation and further aspiration be prevented sufficient damage to the lungs may already have been perpetrated so that life may be shortened

THERAPY

Various treatments of cardiospasm fall into three groups (1) medicinal (2) dilatation (3) surgical

Medicinal

Since the basic abnormality in cardiospasm seems to reside in neuromuscular dysfunction, it would be reasonable to suppose that this might be affected by appropriate drug therapy

The nitrates known to relax smooth muscle are said to be effective in temporarily relieving the obstruction associated with cardiospasm Amyl nitrite nitroglycerin and octyl nitrite may produce transient benefit but side effects may be conspicuous

Although symptomatic improvement has been reported following anticholinergic medication no significant benefit following medicinal treatment alone has been observed in any large series

Dilatation

Most patients can be relieved at least temporarily of the symptoms of cardiospasm by dilatation of the region of the esophagogastric junction This can be accomplished by the passage of mercury weighted bougies (up to No 60F) by olive tipped bougies introduced over a string or by treatment with an expanding type of dilator (pneumatic hydrostatic or metallic) The effectiveness of forceful dilatation is due presumably to rupture or stretching of the muscle fibers of the esophagus in the zone of increased pressure near the cardia Repeated dilatations are often necessary although some patients may be free of symptoms for from several months to years In older patients particularly, a trial of dilatation may be indicated in an attempt to avoid surgical intervention

Complications (tear in the esophagus or stomach) occur but are infrequent and the use of antibacterial agents has lessened the dangers of mediastinitis

Surgical

The extent of the role of surgical management of cardiospasm has fluctuated over the years Many have reserved operative intervention for those patients who failed to respond to nonoperative methods With the widespread improvements in all aspects of surgical management and with evaluation of the results of various operations a larger number of patients are being subjected to operation as the primary treatment for cardiospasm

Among the surgical procedures that have been used in the treatment of cardiospasm are (1) A longitudinal incision through the esophagogastric junction with transverse closure (Heineke Mikulicz cardioplasty) (2) a U shaped incision from the esophagus to the cardia across the esophagogastric junction with closure forming a wide esophagogastric anastomosis (Heyrovsky Grondahl cardioplasty) (3) resection of the lower esophagus and the adjacent portion or the greater part of the stomach with esophagogastrostomy or esophagoantrostomy (4) resection of the esophagogastric junction with esophagojejunostomy in Roux Y fashion and preservation of most of the stomach (5) resection of the esophagogastric junction with interposition of a segment of jejunum or colon between the esophagus and the stomach (6) A longitudinal incision through the muscular wall of the lower esophagus and proximal stomach pre

serving the mucosa intact (Heller cardiomy otomy)

The cardioplastic procedures popular several years ago gave immediate good results with relief of dysphagia and return of the esophagus toward normal size However, the occurrence of esophagitis with its com plications a few years after operation has lessened enthusiasm for these operations Esophagogastrostomy likewise has resulted in esophagitis Esophagoantrostomy with re moval of the acid secreting portion of the stomach, is followed by megaloblastic anemia in a high percentage of cases and by esoph agitis as a result of regurgitation of duodenal contents Resection of the esophagogastric junction with esophagojejunostomy in Roux Y fashion allows for normal deglutition and prevents the development of esophagitis However this operation is of considerable magnitude and may be associated with symptoms of dumping and failure to gain weight Likewise following the interposition of a segment of jejunum or colon between the esophagus and stomach with resection of the esophagogastric junction esophagitis does not develop The possibility of the de velopment of the dumping syndrome is mini

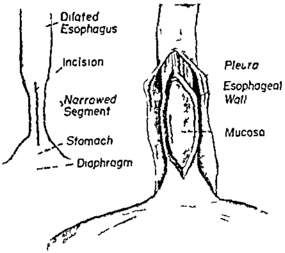


Fig 9 6 Drawing illustrating method of esoph agomyotomy (modified Heller procedure) (*After F H Ellis Jr A M Olsen C B Hol man and C F Code Surgical Treatment of Cardiospasm J A M A* 166 29 1958 *Fig* 2)

mized but this is also a formidable proce dure

The most satisfactory and simplest oper ation yet devised for the treatment of cardio spasm is cardiomyotomy (Fig 9 6) This can be accomplished via a thoracic or ab dominal approach In the elderly or poor risk patient or in situations where other in traabdominal abnormalities are suspected the abdominal approach seems preferable Moreover, a pyloroplasty can be performed when the abdomen is open This ancillary procedure is recommended to allow for more rapid emptying of the stomach thus minimizing the chances of reflux of gastric contents into the esophagus In addition even should regurgitation occur admixture of alkaline duodenal secretions with gastric juice forms a combination that is less harm ful to the esophageal mucosa than unaltered gastric contents

In the past more patients were seen with an advanced state of cachexia associated with cardiospasm Gastrostomy was often performed as an urgent measure to improve their nutrition Today with improved meth ods of parenteral feeding gastrostomy is required infrequently However, in the very elderly or poor risk patient this operation may be helpful and at times lifesaving Then with the nutritional status restored to nearly normal decision concerning treatment by dilatation or by surgical attack on the lesion can be made Should cardiovascular, renal pulmonary or other disease contraindicate further operative intervention the patient may be maintained on gastrostomy feedings To minimize the danger of aspiration into the lungs of saliva and other secretions that may accumulate in the esophagus regular removal perhaps nightly, through a Levin tube should be performed

At The New York Hospital the records of 89 patients with cardiospasm were re viewed Most of these patients and an in determinate number of outpatients had been treated by drugs (e g belladonna) and/or dilatation The results of this therapy could

not be evaluated because follow up studies were inadequate or the patients did not complete treatment suggesting that the outcome may have been unsatisfactory in many cases Thirty (34 per cent) of the 89 patients with cardiospasm who were admitted to the hospital underwent operations

Late follow up studies of the patients treated by procedures at the esophagogastric junction that permitted reflux of gastric contents into the esophagus (e g cardioplasty) showed generally poor results in both the younger and older patients Esophagitis with ulceration stricture formation or both was present in 11 of 15 (73 per cent) Thirteen patients underwent the Heller myotomy procedure and the results were good in 9 (75 per cent) fair in 1 poor in 2 and undetermined in another Among the 7 patients over 50 years of age subjected to the Heller operation the results were good in 5 poor in 1 and undetermined in another

CONCLUSIONS AND RECOMMENDATIONS

The management of cardiospasm in the older age group presents more serious problems than those found in younger patients The effects of long standing esophageal obstruction are less well tolerated in the elderly Diminished pulmonary reserve may be further embarrassed by aspiration and pulmonary infection of acute nature Chronic pulmonary infection and fibrosis may lead to cardiac failure Malnutrition presents its own special problems

One of two methods of treatment is applicable to the case at hand Dilatation by one of several techniques results in a high percentage of good results in patients with cardiospasm and is the therapy preferred by many In the poor risk elderly patient it is probably the procedure of choice

With modern improvements in preoperative management that aim to restore to as nearly normal as possible the various functions of the older patient surgical correction of the abnormality at the esophagogastric junction by myotomy can be safely carried out in most geriatric patients In a high percentage satisfactory results are obtained and the patients are able to return to a more nearly normal status

BIBLIOGRAPHY

Brewer McH S Barnes W A and Redo S F Evaluation of Operative Procedures for Achalasia Ann Surg 144 823 1956

Ellis F H Jr Olsen A M Holman C B and Code C F Surgical Treatment of Cardiospasm (Achalasia of the Esophagus) J A M A 166 29 1958

Heller E Extramukose Cardiaplastik beim chronischen Cardiospasmus mit Dilatation des Oesophagus Mitt Grenzgeb Med u Chir 27 141 1913

Heyrovsky H Casuistik und Therapie der idiopathischem Dilatation der Speiserohe Oesophagogastro-anastamosis Arch klin Chir 100 703 1912–1913

Oschsner A and De Bakey M Surgical Considerations of Achalasia Arch Surg 41 1146 1940

Sleisenger M H Steinberg H and Almy T P Disturbance of Esophageal Motility in Cardiospasm Studies on Autonomic Stimulation and Autonomic Blockade of Human Esophagus Including Cardia Gastroenterology 25 333 1953

Wendel W Zur Chirurgie des Oesophagus Arch klin Chir 93 311 1910

Wilkins E W Jr Current Considerations of Esophageal Physiology Normal and Abnormal New England J Med 257 24 1957

10

Diaphragmatic Hernia

William A Barnes

The term *diaphragmatic hernia* is used to describe the protrusion of any of the abdominal contents into the thoracic cavity through a natural or acquired defect in the diaphragm The several openings and types of hernia are indicated in Table 10 1 and Fig 10 1

Traumatic Diaphragmatic Hernia

This can occur at any age and results from direct or indirect violence (Fig 10 2) With penetrating wounds e g, stab or missile exploratory thoracotomy or laparotomy performed for known or suspected visceral injury will reveal the diaphragmatic disruption and lead to prompt repair

Contusions of the thorax or abdomen resulting from a severe fall or sudden impact as in the ever increasing number of automobile accidents can produce a tear in the diaphragm with minimal or no signs of external injury Almost all of these occur in the left diaphragm The presence of a traumatic hernia may be easily overlooked either because of few symptoms or because attention is directed to more severe concomitant injuries

Prompt repair of the hernia is indicated although in most cases this is not an emer

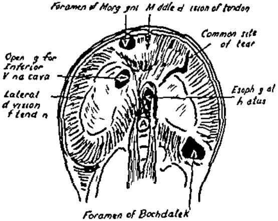


Fig 10 1 Drawing of the diaphragm viewed from below indicating sites of various hernias

TABLE 10 1 TYPES OF DIAPHRAGMATIC HERNIA

Type	*Opening*	*Age group*	*Approx per cent of total hernias*
Traumatic	Tear in dome	Any	13
Postoperative	Disrupture of suture line	Any	<1
Pleuroperitoneal	Foramen of Bochdalek	Infancy	5
Parasternal	Foramen of Morgagni (Larrey s space)	5th–6th decade	2
Esophageal	Esophageal hiatus		80
Congenital		Infancy–Adult	<2
Paraesophageal		5th–6th decade	20 } >10
Sliding		5th–6th decade	70



Fig 10-2 Traumatic diaphragmatic hernia Stomach and liver herniated through a tear in the left leaf of diaphragm (N Y H No 618253)

gency The transthoracic approach is used with reduction of the herniated viscera and repair of the defect with nonabsorbable suture material Crushing the phrenic nerve may be helpful in reducing the hernia and in relieving tension on the suture line

Large defects may require grafts of fascia or the use of sheets of synthetic material such as Ivalon sponge

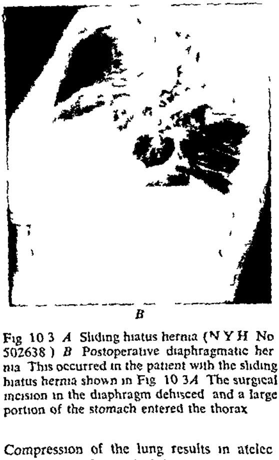
A rare type of hernia can occur following disruption of a suture line in the diaphragm (Fig 10 3) The diaphragm contains powerful muscle and extreme care must be taken in closing defects particularly those which are man made

Pleuroperitoneal Hernia

Hernia through the *foramen of Bochdalek* occurs in infancy and is mentioned here only for completeness This foramen results from incomplete fusion of the lateral portion of the diaphragm and through the usually large opening abdominal viscera enter the thorax



A



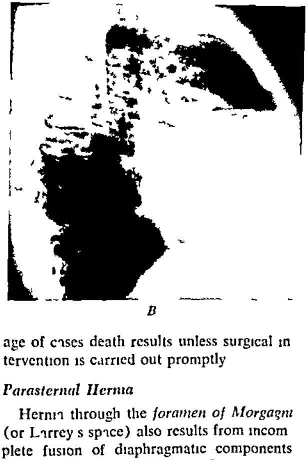
B

Fig 10 3 *A* Sliding hiatus hernia (N Y H No 502638) *B* Postoperative diaphragmatic hernia This occurred in the patient with the sliding hiatus hernia shown in Fig 10 3*A* The surgical incision in the diaphragm dehisced and a large portion of the stomach entered the thorax

Compression of the lung results in atelectasis and mediastinal shift to the opposite side with resultant cyanosis dyspnea and cardiac embarrassment In a high percent



A



B



C

Fig 10 4 *A* Parasternal hernia (herniation through the foramen of Morgagni) (N Y H No 173529) Roentgenogram of chest (posterior anterior view) showing obscuration of the right lower lung field *B* Roentgenogram of chest (lateral view indicating the anterior location of the mass *C* Barium enema outlining a portion of the colon in the thorax

age of cases death results unless surgical intervention is carried out promptly

Parasternal Hernia

Hernia through the *foramen of Morgagni* (or Larrey s space) also results from incomplete fusion of diaphragmatic components (sternal and costal portions) However unlike hernia through the foramen of Bochdalek evidence of this congenital de usually does not occur until middle a later Symptoms may be absent or The neck of t sac is usual large hence of in

or strangulation of its contents is ever present With incarcerated omentum there may be lower substernal or upper abdominal discomfort When the colon is involved constipation or infrequently symptoms and signs of intestinal obstruction may develop An asymptomatic hernia may be revealed on routine x ray examination of the chest Lateral views show a mass closely applied to the posterior aspect of the sternum (Fig 10-4) The nature of the contents may be established by appropriate x ray studies (barium enema and gastrointestinal series) (Fig 10 4) Repair of the defect is readily accomplished by a transabdominal approach

Esophageal Hiatus Hernia

By far the most common diaphragmatic ias are those associated with the eso- l hiatus The problems of esophageal a with symptoms have increased in the few decades a result at least in part n

The incidence of hiatus hernias in the general population has been estimated at 0 5 to 0 8 per 1 000 This may be low because small hernias are frequently missed on routine or even special radiographic examination The condition occurs most often in females Estimates of the female male ratio vary from 1 5 1 to 4 1 Among patients with upper abdominal symptoms, the incidence may be 8 to 10 per cent with the highest percentage in the older age group (as high as 33 per cent) Two thirds of the patients are more than 50 years old In one series of 197 patients the diagnosis was established between the ages 31 to 40 in only 21 between the ages 41 to 50 in 70 and between the ages 51 to 60 in 106 patients There is often a long interval between the onset of symptoms and the time of diagnosis

The incidence of radiologic evidence of concomitant disease in patients with hiatus hernia has been reported as high as 25 per cent Peptic ulcer cholelithiasis and diverticulosis are the most important associated gastrointestinal conditions It is still debatable whether Saint s triad consisting of hiatus hernia sigmoid diverticula and cholelithiasis is the result of the chance concurrence of these conditions all of which are common in the older age group or whether these pathologic conditions occur together more frequently than can be expected on the basis of chance alone

The types of esophageal hiatus hernia are congenital (2 per cent) sliding (70 per cent) paraesophageal (20 per cent) and a combination of the latter two (10 per cent) In Table 10 2 and Fig 10 5 are indicated the anatomic differences among types of esophageal hiatus hernias Of principal importance is consideration of the esophagogastric junction In the paraesophageal hernia the normal positions and relationships of the esophagogastric junction are maintained In the congenital and sliding types the esophagogastric junction is in the thorax with loss of the usual acute angle between the esophagus and stomach and with absence of support of the right crus of the diaphragm

DIAGNOSIS

The diagnosis of hiatus hernia and its complications is made on the basis of *symptomatology* and *x ray* and *esophagoscopic examinations* The symptomatology prognosis and treatment of the various types vary considerably and are related in considerable degree to the morbid anatomy We shall not consider further the rarer types (traumatic and hernia through the foramen of Morgagni or of Bochdalek)

Symptomatology

Congenital hiatus hernia is mentioned only to indicate that it is not truly a hernia It *is a mediastinal stomach that never descended* to its usual position below the diaphragm There is no sac of parietal perito-

TABLE 10 2 CHARACTERISTICS OF TYPES OF ESOPHAGEAL HIATUS HERNIAS

	True congenital	*Paraesophageal*	*Sliding*
Length of esophagus	Short	Normal	Apparently short
Position of esophagogastric junction	In thorax	Normal below diaphragm	In thorax
Length of phrenoesophageal ligament	Normal (attached to stomach)	Normal	Lengthened
Covering of herniated mass	Uncovered by peritoneum	Gastric serosa and peritoneum	In part uncovered by peritoneum
Degree of angulation between esophagus and cardia	Angulation obtuse or absent	Normal—acute	Angulation obtuse or absent
Esophagitis	Frequent	Rare	Frequent

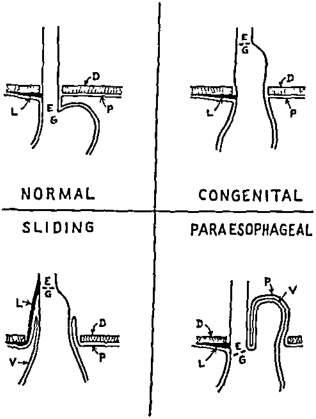


Fig 10 5 Diagram indicating relationships at the esophageal hiatus in the normal subject and with various types of esophageal hiatus hernia (*D*) diaphragm (*P*) parietal peritoneum (*V*) visceral peritoneum (*L*) phrenoesophageal ligament (*E G*) esophagogastric junction Note the acute angle between esophagus and stomach in the normal subject and in para esophageal hernia and its absence in congeni tal and sliding hernias

neum (Fig 10 5) In symptomatology it parallels *sliding hiatus hernia*

The history of a patient with *sliding hiatus hernia* is usually characteristic The patient most often a female complains of a lower substernal or high epigastric burning sensa tion frequently with a sense of fullness tight ness or ulcerlike distress This sensation is increased after eating particularly following heavy meals and is aggravated by reclining straining bending over or wearing tight ab dominal garments (corsets) The patient may waken at night with severe substernal pain and obtain relief by the ingestion of milk or an antacid preparation In about one-third of the patients symptoms are referred to the cardiac region

Dysphagia is a frequent manifestation Food is felt to be arrested in the lower sub sternal region The patient complains of heartburn and may notice regurgitation of fluid into the mouth on bending over or sometimes on reclining

These symptoms result in large part from regurgitation of gastric contents into the esophagus, and, if unrelieved the complica tions of esophagitis (hemorrhage or stric ture) may follow

The paraesophageal hernia is not likely to be associated with symptoms of esophagitis because the mechanism at the esophagogas tric junction is competent preventing reflux Symptoms may be ill defined and mainly are due to flatulence or are the result of anemia The stomach alone is usually found in this hernia Most of the viscus or the entire or gan may herniate producing an upside down stomach since it remains fixed at the esoph agogastric junction and at the pylorus (Fig 10 6) At times the colon and greater omen tum find their way into the sac The hernia



Fig 10 6 Paraesophageal hernia (so called upside down stomach) (N Y H No 128001)

is usually reducible in the erect position but incarceration and even strangulation can occur Bleeding of chronic or acute nature is not uncommon and is associated with hyperemia of the mucosa gastritis or ulcer in the incarcerated segment Iron deficiency anemia is found in more than 50 per cent of these cases Occasionally carcinoma is found in the herniated stomach

A combination of paraesophageal and sliding type occurs in about 10 per cent of esophageal hiatus hernias with the manifestations of either or both types

In some patients sudden severe pain occurs in the subxiphoid area and passes directly through to the back or around the costal margins It may disappear as suddenly as it occurred There may be slight spasm of the upper recti muscles but no other clinical or laboratory abnormalities are evident This pain presumably results from visceral spasm associated with temporary incarceration of a portion of the stomach in the sac at the esophageal hiatus

X ray Examination

While the larger uncomplicated esophageal hiatus hernias offer no difficulty in diagnosis by x ray examination smaller hernias may be difficult to demonstrate Examination in the Trendelenburg position with the patient straining to increase intraabdominal pressure may reveal a hernia not otherwise observable

It is not always possible to demonstrate the site of entrance of the esophagus into the stomach Hence the radiologist may not be able to state whether a paraesophageal or sliding type hernia is present

The phrenic ampulla is frequently confused with a small sliding hiatus hernia

The diagnosis of esophagitis by x ray studies presents a more difficult problem With early changes i e erosion of mucosa and infiltration by inflammatory cells only slight fuzziness of the mucosa spasm or no abnormality at all may be evident on the x ray films It is only when ulceration or fibrosis with stenosis and dilatation proximally are present that esophagitis may be recognized In these cases particularly the differentiation from carcinoma must be considered

Esophagoscopic Examination

Confirmation of the diagnosis of sliding esophageal hiatus hernia often can be made by esophagoscopic examination This is not so with paraesophageal hiatus hernia where the esophagogastric junction is at its normal distance from the upper gingival margin (usually 40 cm) and the appearance of the rosette is normal without signs of esophagitis

With a sliding hiatus hernia the esophagogastric junction usually lies above the level of the diaphragm This may not be immediately evident because in the absence of inflammatory change this site may descend readily ahead of the esophagoscope as it is advanced This junction may be demonstrated by placing through the esophagoscope a metallic clip at the beginning of gastric mucosa A biopsy at this site is made to prove the presence of gastric glands Subsequent x ray examination will then demonstrate the clip and the esophagogastric junction to lie above the diaphragm The usual slight resistance and the angulation encountered at the esophagogastric junction in a normal individual are generally absent when a sliding hiatus hernia is present Moreover even before the junction is reached gastric contents may well up into the esophagoscope indicating incompetence of the esophagogastric mechanism

Esophagitis is manifest by redness friability and edema of the mucosa particularly in the lower third of the esophagus Small erosions or ulcers often with an overlying yellowish membrane may be evident A cobblestone appearance is often seen Advanced cases will be associated with rigidity and narrowing of the lumen so that identification of the esophagogastric junction may be impossible As many as 40 per cent of patients with hiatus hernia who are studied by esophagoscopy are found to have esophagitis al

though this figure varies widely in different series

An important function of the esophagoscopic examination is to establish the presence or absence of carcinoma This may be accomplished by biopsy of several areas and aspiration of the contents of the lower esophagus for microscopic examination (Papanicolaou technique) Another method is to wipe the walls of the lower esophagus and cardia with a pledget of Gelfoam that is subsequently fixed embedded sectioned stained and examined for groups of malignant cells Even after repeated examination, carcinoma, although present may be missed

Differential Diagnosis

It is when esophagitis and its complications of stricture or bleeding are present that problems in differential diagnosis usually arise As indicated above carcinoma of the lower esophagus or cardia is the most important and sometimes the most difficult to differentiate Other conditions include benign tumors cardiospasm and scleroderma The differential diagnosis is discussed in Chap 9 and outlined in Table 9 2

The differentiation between angina from coronary arterial insufficiency and angina produced by a hiatus hernia has long been a problem Likewise, dyspepsia caused by gallbladder disease and dyspepsia of hiatus hernia origin are often confused Pneumoperitoneum has been advocated as a means whereby the origin of these symptoms can be identified Relief of symptoms after the induction of pneumoperitoneum suggests the origin from hiatus hernia The physiologic mechanisms by which relief of symptoms of sliding hiatus hernia is obtained by pneumoperitoneum are not clear The herniated segment does not return to the abdominal cavity in every case yet patients may be benefited Pneumoperitoneum elevates the diaphragm and tightens the crus producing a sphincter-like action that may help prevent gastric reflux

CLINICAL COURSE

The clinical course of patients with esophageal hiatus hernia is extremely variable The hernia is often discovered during the course of investigations of unrelated conditions In these patients many in the older age group symptoms may never develop and the usual life span may be bridged with no manifestations of the abnormality

For others mild symptoms such as heartburn occasional regurgitation and subxiphoid discomfort may persist intermittently over the years with no objective evidence of serious esophagitis or progression in the size of the hernia

In another group however, progressive symptoms may result from enlargement of paraesophageal hernia or from esophagitis associated with reflux of gastric contents in a sliding hernia It is in these individuals that recognition of the progress of the condition is vital so that appropriate measures may be taken to prevent serious complications

As previously noted the complications of esophageal hiatus hernia differ with the type of hernia

With paraesophageal hernia bleeding is one of the more frequent complications While the loss of blood may be chronic and evidenced by fatigue and general weakness more rapid hemorrhage can be of serious consequence especially in the aged Incarceration of the stomach for short periods or permanently may be associated with severe discomfort in the lower chest Strangulation of a portion or most of the stomach and omentum occurs less commonly but requires immediate surgical intervention

In patients with sliding hiatus hernia because of disruption of the normal relations in the region of the esophagogastric junction the barrier to gastroesophageal reflux is broken The single most important factor appears to be the loss of the normal acute angulation between the esophagus and stomach In addition the esophagogastric junc

tion lies above the diaphragm whose function in angulating the lower esophagus is abolished The intrinsic sphincter mechanism in the lower esophagus is apparently disturbed and is ineffective by itself in preventing reflux The effects of reflux of gastric contents into the esophagus can be well tolerated by some but in others esophagitis with its devastating complications of ulcer (Fig 10 7) hemorrhage and stricture formation (Fig 10 8) will supervene



Fig 10 8 Sliding hiatus hernia with stricture of the lower esophagus At operation a penetrating ulcer at the esophagogastric junction was found (*From W A Bernes and R S McElwee Surgical Treatment of Non neoplastic Lesions at the Esophago gastric Junction Ann Surg* 137 523 1953 *Fig* 2)

THERAPY

The management of patients with esophageal hiatus hernia may be divided into three phases

Those individuals particularly in the older age group in whom the hernia was discovered accidentally and who have no related symptoms may be followed with no specific therapy Should symptoms develop the patients fall into the next group

In the group with mild intermittent manifestations usually of several years duration a base line of pathologic alterations should be established After careful evaluation by x ray studies esophagoscopic examination is done to rule out carcinoma to determine whether or not esophagitis is present and if so to grade its severity Repeated examinations of the stool for occult blood are made



Fig 10-7 Sliding hiatus hernia with an ulcer (arrow) near the esophagogastric junction (N Y H No 74431)

Medical Management

The patient is then placed on a trial of medical management This is designed (1) to reduce the volume acidity and peptic activity of gastric contents and (2) to prevent or minimize mechanically reflux of gastric contents into the esophagus The former is done by frequent feedings antacids and anticholinergic drugs (e g tincture of belladonna and Banthine) In the aged the anticholinergic drugs must be used with care to avoid ophthalmologic cardiovascular and/or urologic complications

Regurgitation is minimized by eliminating tight abdominal clothing and by avoiding bending over and straining The head of the patient s bed is elevated on blocks 6 in high, or a back rest is placed under the mattress to elevate the shoulders 6 to 10 in above the hips to prevent nocturnal regurgitation

Weight reduction is encouraged to help reduce intraabdominal pressure

As the esophagitis heals careful dilatation may be indicated at times to help prevent stricture formation

A careful follow up of the patient s symptoms and changes in the x ray and esophagoscopic findings will suggest whether this type of management should continue or whether surgical intervention is necessary

Surgical Management

With persistence or progression of symptoms and signs in spite of the regimen outlined above, surgical correction of the hernia is indicated to relieve symptoms and to prevent serious complications It is true that many years may elapse between the onset of early symptoms and signs of esophagitis and the occurrence of ulceration with serious hemorrhage perforation, or stricture formation However, these changes may also occur under presumably competent observation

The procedure of choice is repair of the hiatus hernia with restoration to as nearly normal as possible of the relationship of the structures in the region of the esophagogastric junction Whether the repair be accomplished transabdominally or transthoracically varies with the surgeon s training and aptitudes While it is generally technically easier and more satisfactory to repair most hernias transthoracically, other considerations particularly in the older age group of patients may make the abdominal approach preferable (Fig 10 9) If there is knowledge or suspicion of other intraabdominal disease exploration through an abdominal incision is to be preferred Moreover by avoiding entrance into the pleural space the chances of postoperative thoracic complications (effusion pneumothorax, pneumonia and intercostal pain) are reduced or eliminated

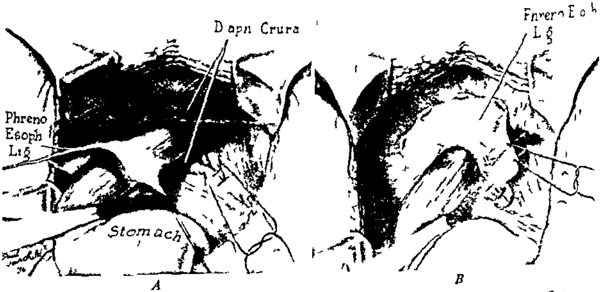


Fig 10 9 Transabdominal method of repair of sliding hiatus hernia (*From G M Carver Hiatus Hernia Peptic Ulcer Surg Gynec & Obst* 106 77 1958 *Figs 2 and 3*) *A* Phrenoesophageal ligament dissected from cardia of the stomach and its diaphragmatic attachments but left attached to the esophagus Muscle fibers of the right crus approximated with interrupted No 00 silk sutures *B* Phrenoesophageal ligament sutured to the undersurface of the diaphragm completing transabdominal repair of hiatus hernia

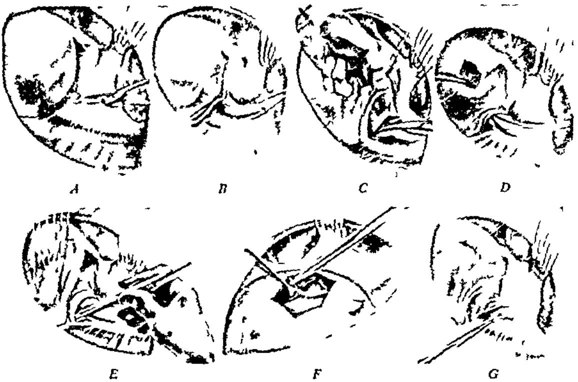


Fig 10-10 *A–G* Transthoracic method of repair of sliding hiatus hernia (*From P R Allison Reflux Esophagitis Sliding Hiatal Hernia and the Anatomy of Repair Surg Gynec & Obst 92 419 1951 Figs 11 to 17 inclusive*)

The classic description of the transthoracic repair of a sliding hiatus hernia by Allison is illustrated in Fig 10 10

With paraesophageal hernias the surgical correction usually is simpler and recurrences should be fewer than with the sliding hernias Should difficulty be encountered in returning the herniated portion of stomach into the abdominal cavity the passage of a catheter between the stomach and neck of the sac will reduce the negative pressure in the sac and allow the herniated viscus to be replaced with ease The sac is then freed and closed at its neck and the diaphragm sutured about the lower esophagus

With a large number of hiatus hernias occurring in the older age group efforts have been directed to evolving procedures of lesser magnitude than the repairs outlined above

Division of the left phrenic nerve has been utilized in the treatment of esophageal hiatus hernia of all types and excellent results have been claimed in a high percentage of cases In patients bleeding from a paraesophageal hernia due to mucosal congestion from constriction at the hiatus such a procedure may have grounds for success With sliding hernias it is more difficult to explain the value of section of the phrenic nerve

Gastropexy consisting in drawing the stomach downward and suturing it to the anterior abdominal wall has been suggested as a simple means of treatment While the advantages of an abdominal approach in a poor risk elderly patient are evident it is unlikely that in patients with sliding hernias gastroesophageal reflux would be prevented by this procedure Patients with paraesophageal hernias who have episodes of pain or dysphagia could conceivably benefit from this operation but such hernias usually can be repaired directly and easily through an abdominal approach

In recent years a nonoperative approach pneumoperitoneum has been utilized with

success in the treatment of certain manifestations of esophageal hiatus hernias in elderly poor-risk patients As noted in the section on Differential Diagnosis the mechanisms whereby relief of vomiting dysphagia, and hemorrhage associated with sliding hiatus hernia is obtained, are not entirely clear, but pneumoperitoneum is an important adjuvant in the management of geriatic patients with symptomatic hiatus hernias

It is when the serious complications of persistent hemorrhage or especially strictures develop that grave problems in management of hiatus hernia are presented Operative intervention at the esophagogastric junction (resection with esophagogastrostomy, cardioplasty, etc) is often followed by the development or persistence of esophagitis and its complications Surgical attempts to prevent this occurrence may be divided into two groups, as follows

I Procedures that aim to reduce the volume acidity and peptic activity of gastric contents
   A Standard subtotal gastrectomy with gastroduodenostomy or gastroenterostomy (Billroth I and II procedures)
   B Resection the distal esophagus and varying portions of the proximal stomach with esophagogastrostomy
   C Vagectomy with or without gastrojejunostomy or pyloroplasty
   D Resection of the esophagogastric junction and antrum and vagectomy with esophagogastrostomy and gastroduodenostomy

II Procedures that aim to prevent reflux of gastric contents into the esophagus
   A Resection of the esophagogastric junction with vagectomy and esophagojejunostomy (Roux Y) (exclusion of stomach from direct continuity with the intestinal tract)
   B Resection of the esophagogastric junction with interposition of segment of jejunum or colon
   C Implantation of the esophagus obliquely through the wall of the stomach
   D Formation of valves at the esophagogastric junction
   E Resection of the esophagogastric junction with implantation of plastic prosthesis between esophagus and stomach
   F Total gastrectomy with esophagojejunostomy

Each procedure has its advocates There is no unanimity of opinion concerning the ideal method of reestablishing continuity of the alimentary tract following surgical procedures that remove or destroy the normal relations at the esophagogastric junction Yet the principle of keeping gastric and duodenal secretions out of the esophagus is a sound one, and operations that effect this eliminate or prevent esophagitis

Gastrostomy is seldom indicated in the management of patients with the complications of hiatus hernia It is a rare stricture that cannot be dilated to permit alimentation and restoration of the patient s nutritional status to more nearly normal Yet should gastrostomy be necessary, retrograde dilatation with the Tucker dilators can be accomplished readily

In the geriatric patient who has a short life expectancy and who is a poor operative risk the decision has to be made whether to attempt definitive surgical cure or whether to continue medical management with use of dilatation to overcome obstruction from strictures even though the patient may not be rendered symptom free

DATA

With better understanding of the pathologic physiology of the geriatric patient and with newer advances in pre and postoperative management improvements have been made in the surgical management of patients with diaphragmatic hernia

One of the larger series of patients operated upon for diaphragmatic hernia is that of Harrington Among 430 patients there were 343 with esophageal hiatus hernia 21 with pleuroperitoneal hernia or absent pos

terior portion of the diaphragm 8 with parasternal hernia and 58 with traumatic hernia There were 17 deaths (mortality of 4 per cent) 7 occurring in cases of esophageal hiatus hernia 5 in cases of traumatic hernia and 5 in cases of congenital diaphragmatic hernia Among the 380 cases in which patients recovered from radical repair of the hernia there were recurrences in 9 with esophageal hiatus type (4 with symptoms) and 1 with the congenital type

Myre et al reported on operations on 113 patients with esophageal hiatus hernias Preoperative symptoms were present in 78 per cent of these patients Postoperative symptomatic relief was experienced by more than 90 per cent of those who had had symptoms preoperatively One death occurred and there were recurrences of the hernia in 10 per cent (early follow up)

Weisel et al studied 220 patients with esophageal hiatus hernia Esophagoscopic examination was done on 97 with symptoms of esophageal disease and 46 were found to have ulcerative esophagitis Of these 30 underwent transthoracic repair of the hernia The esophagitis healed in 28 and 1 developed a stricture in the other the hernia recurred but on subsequent successful repair the esophagitis disappeared Among the remaining 16 patients 5 underwent resection for stenotic lesions and the other 11 were treated by dilatation and medical management In none of the 11 did the esophagitis heal

Such studies indicated that if a successful repair of the hernia is accomplished preventing gastroesophageal reflux esophagitis will disappear

At The New York Hospital a review of approximately 250 patients in whom a diagnosis of diaphragmatic hernia was made during their hospitalization revealed a higher incidence among females (3 2)

Since the classic description of the transthoracic repair of hiatus hernias by Allison most of the cases at The New York Hospital have been satisfactorily operated upon through the chest In the older age group the advantages of the transabdominal approach noted above have been appreciated

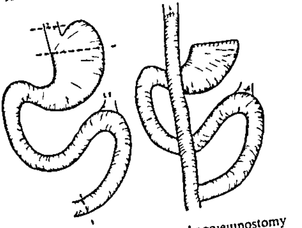


Fig 10-11 Diagram of esophagojejunostomy in Roux Y fashion The region of the esophagogastric junction is resected The jejunum is divided 20 cm from the ligament of Treitz (*LT*) and esophagojejunostomy and jejunojejunostomy performed (*From S F Redo and W A Barnes Morphologic and Physiologic Studies on the Gastric Remnant following Resection of the Esophagogastric Junction and Esophagojejunostomy* Surg Gynec & Obst 99 310 1954 *Fig* 1)

A combined thoracoabdominal approach has been utilized in several patients with complications (e g shortened esophagus with stricture) that precluded the usual repair Following resection of the esophagogastric junction a Roux Y esophagojejunostomy with exclusion of the remaining stomach (Fig 10 11) or interposition of a segment of jejunum between the esophagus and stomach (Fig 10 12) has been done with generally good results

CONCLUSIONS AND RECOMMENDATIONS

In the vast majority of cases the management of the geriatric patient with diaphragmatic hernia deals with the complications of sliding and paraesophageal hiatus hernias With uncomplicated hernias and in the absence of symptoms no treatment is necessary With mild manifestations a trial of medical management combined with close observation of the response to treatment is justified Should improvement follow this course may be continued With progression

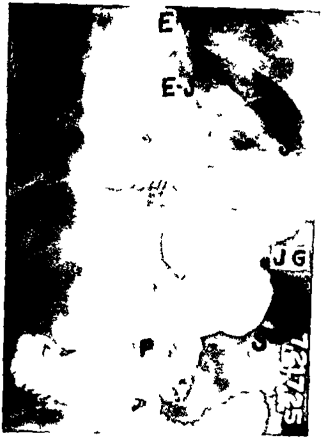


Fig 10 12 Roentgenographic study of the upper gastrointestinal tract following resection of the esophagogastric junction pyloroplasty and interposition of a segment of jejunum between the esophagus and stomach *E* esophagus *E J* esophagojejunal junction *J* jejunum *J G* jejunogastric junction *S* stomach *P* region of pyloroplasty (*From W A Barnes and M H Sleisenger Physiological Considerations in the Surgical Management of Disorders of the Esophagus S Clin North America* 38 331 1958)

of signs and symptoms repair of the hernia is indicated to prevent the serious complications of hemorrhage perforation, or stricture

When the usual repair of the hernia is prevented by other factors (e g shortened esophagus with stricture) choice must be made of a surgical procedure that will prevent recurrence of complications and restore alimentation to as nearly normal as possible Operations that prevent reflux of gastric or duodenal contents into the esophagus are preferable to those that attempt to reduce the quantity and quality of secretions that can reflux into the esophagus

When major surgical intervention is contraindicated, a combination of medical management and the judicious use of esophageal dilatation may allow the patient to resume a nearly normal life, albeit often not symptom free

BIBLIOGRAPHY

Allison P R Reflux Esophagitis Sliding Hiatal Hernia and Anatomy of Repair Surg Gynec & Obst 92 419 1951

Allison P R Observations on Conservative Approach to Non malignant Lesions at Cardia J Thoracic Surg 32 150 1956

Barnes W A and Sleisenger M H Physiological Considerations in the Surgical Management of Disorders of the Esophagus S Clin North America 38 331 1958

Ferguson D J Sanchez Palomera E Sako Y Clatworthy H W Toon R W and Wangensteen O H Studies on Experimental Esophagitis Surgery 28 1022 1950

Foster J J and Knutson D L Association of Cholelithiasis Hiatus Hernia and Diverticulosis Coli J A M A 168 257 1958

Gross F S and Kay E B Etiology and Treatment of Peptic Esophagitis Ann Surg 143 360 1956

Harrington S W Esophageal Hiatal Diaphragmatic Hernia Surg Gynec & Obst 100 277 1955

Maisel B Cooper W and Glenn F Pneumoperitoneum in the Management of Hiatus Hernia J Am Women s M A 11 239 1956

Myre T T Kirklin J W Andersen H A and Clagett O T Surgical Considerations in the Treatment of Esophageal Hiatus Hernia J A M A 164 147 1957

Symposium on the Esophagus and Its Diseases Am J Surg 93 154 1957

Weisel W Raine F and Watson R R The Efficiency of Esophageal Hiatal Hernia Repair Surg Gynec & Obst 104 471 1957

Part 3

Cardiovascular Surgery

11

Cardiac Surgery

George R. Holswade and Frank Glenn

Cardiac surgery in general is such a new field of endeavor that so far only relatively few patients in the older age group have been subjected to operative procedures on the heart. Except for an occasional isolated pioneering operation for many years any surgery performed on the heart was limited to the suturing of wounds. Later pericardiectomy for calcific pericarditis became a safe and well-established procedure. But it was only 20 years ago that the door to modern cardiac surgery was opened when Gross performed the first successful ligation of a patent ductus arteriosus.

The next decade, 1938 to 1948, was marked by the development of surgical techniques for the treatment of a number of other congenital cardiac anomalies. Blalock and Taussig originated a method of shunting additional blood into the pulmonary circuit of blue babies by performing an anastomosis between a systemic artery, the subclavian artery, and the pulmonary artery. Although this was not a curative procedure it did produce remarkable improvement in these cyanotic children. Potts modified the Blalock procedure somewhat by anastomosing the aorta directly to the pulmonary artery. This modification was particularly useful in small babies with tiny subclavian arteries. Surgical correction of the aorta was achieved by Crafoord and Gross independently. Simple excision of the narrowed portion of the aorta with end to end anastomosis was the original technique. Later Gross introduced the use of preserved homografts and made operation possible in cases where there was a hypoplastic segment of aorta or where poststenotic dilatation or aneurysm formation was a problem. For valvular pulmonic stenosis Brock introduced a blind method of opening the valve. A series of knives and dilators were passed through a small opening in the wall of the right ventricle up through the pulmonic valve. However, since all these procedures were for congenital defects they were for the most part performed on infants, children or young adults.

During the last 10 years further advances have greatly widened the scope of cardiac surgery. Successful surgical procedures have been made available for many other congenital cardiac defects and many existing techniques have been greatly modified and improved. Moreover successful surgical treatment of acquired heart disease now is a reality. Mitral stenosis, the commonest sequela of rheumatic fever, was the first of the acquired valvular lesions to be approached surgically with satisfactory results. Bailey and Harken independently performed successful operations in which the mitral orifice was enlarged by opening the fused commissures with the aid of special knives or by finger fracture. This closed or blind procedure on the mitral valve has proved highly successful and is probably the cardiac operation performed most frequently at the present time. Encouraged by the favorable results with mitral valvulotomy procedures were devised to open the stenosed aortic

valve These also were blind procedures, performed originally by expanding knives and dilators through the wall of the left ventricle and later by finger fracture and instrumentation through diverticula sewed to the aorta At about this time the first practical method of dealing with an insufficient cardiac valve was made available Hufnagel devised a plastic ball valve which could be fitted into the descending aorta and which partially corrected aortic insufficiency The Hufnagel valve remains today the most satisfactory clinical method of relieving aortic insufficiency, even though the defect is only partially corrected

Attention was turned now to the correction of certain intracardiac congenital defects and at first the approach was again a blind one Various closed methods were used to correct atrial septal defects The wall of the atrium was invaginated into the defect by several different techniques Circumcluding sutures were passed about the defect and Gross developed a semiclosed method of suturing the defect at the bottom of a well filled with blood and sutured to an opening in the right atrial wall These methods were only moderately successful and attempts to close ventricular septal defects by closed methods also met with little success

The technique of hypothermia made direct vision open heart surgery possible for the first time Bigelow demonstrated in animals that when the temperature had been lowered to 28°C, the circulation could be occluded and the heart opened with survival The first successful application of hypothermia to human cardiac surgery was by Lewis who under direct vision closed an atrial septal defect Swan demonstrated that an open method of operation utilizing hypothermia could be successfully applied to the congenitally stenosed pulmonic valve and that the results by this method were superior to those obtained by the indirect Brock procedure Without doubt hypothermia was a great advance in the field of cardiac surgery but certain disadvantages soon became evident A time limit of less than 8 minutes was placed on the surgeon for his intracardiac work Some surgeons extended this period by using several 4 minute periods for intracardiac work with rest periods in between Another big disadvantage of hypothermia was the increased incidence of ventricular fibrillation which became a definite hazard when temperatures fell below 30°C and when either ventricle was disturbed Nevertheless, atrial septal defects and valvular pulmonic stenosis proved to be two lesions that could be corrected accurately and reasonably safely under hypothermia

In order to correct complicated defects in the heart it was necessary to develop a means of supplying the body with well oxygenated blood in other words an artificial heart lung machine After many years of laboratory research a pump oxygenator was first successfully used by Gibbon in 1953 in the repair of an atrial septal defect Shortly after this Lillehei and Varco developed a technique of controlled cross circulation for open heart surgery In this technique a parent of the same blood type was used as the oxygenator while the blood was pumped mechanically between the child with defect and the donor Although this was a very satisfactory method of oxygenation it did involve considerable risk to the donor and it was abandoned when satisfactory oxygenators were developed

At the present time, a great number of pump oxygenators are in clinical use and an even greater number are being constantly changed and altered in the laboratory There are four basic types of oxygenators (1) stationary screen (2) bubble (3) rotating disk and (4) membrane The stationary screen oxygenators are modifications or simplifications of Gibbon s original design and the largest series of open heart operations with use of this type of equipment has been done by Kirklin in the Mayo Clinic The most widely used bubble type of oxygenator is that developed by DeWall and Lillehei and used successfully in a large series of cardiac procedures in Minneapolis The rotating disk oxygenator in most com

mon use is a modification by Kay and Cross of an original design by Bjork Kolf and Clowes independently have designed membrane oxygenators that so far have had limited clinical applications

With the development and gradual perfection of pump oxygenators, the surgical correction of an ever increasing number of cardiac abnormalities has been made possible At first congenital anomalies in the very young were corrected but gradually persistent symptomatic anomalies in the older age group have been operated upon Rheumatic valvular disease in the older age group now can be approached more safely Intracardiac tumors which occur most commonly after the fifth decade can be successfully removed Probably the most important feature as far as this presentation is concerned is the surgical approaches that are being made to the problem of coronary artery disease and these will be discussed later in the chapter Before leaving the subject of pump oxygenators it would seem a reasonable prediction that in the not too distant future pump oxygenators will be used to supplement the heart and lungs in the elderly and poor risk patients during periods of crisis such as overwhelming infection trauma and noncardiac operations

PHYSIOLOGIC CHANGES

Beyond the fifth decade there are changes in the heart which tend to decrease the efficiency of the heart and the death rate due primarily to failure of the cardiovascular system increases with advancing age

The heart increases both in size and weight whereas other organs of the body tend to atrophy with old age This is due in part to an increase in subpericardial fat and in part to an increase in cardiac muscle mass There is a thickening of the endocardium in the left auricle and left ventricle and about the papillary muscles The microscopic picture of the muscle fibers changes so that with advancing years the nuclei are larger and stain more darkly and the striations about these tend to disappear There are changes in the elastic fibers of the aorta ventricles and auricles The heart valves become less elastic and there is an increase in the calcium and cholesterol deposited in them resulting in decreased efficiency In the coronary arteries there is a progressive increase in calcium deposition and in splitting of the elastic fibers of the internal elastic lamella Changes in the coronary arteries usually occur earliest in the anterior descending branch and are followed by changes in the posterior descending branch

With advancing years there is a decrease in oxygen consumption of the heart which parallels the gradual reduction in basal metabolism of the body as a whole Also diminished is the ability of the heart to increase cardiac output by increasing the rate and strength of contractions when required by strenuous work or exercise There is an increased tendency toward abnormal rhythms of the heart such as premature contractions and paroxysmal auricular fibrillation The heart becomes less sensitive to the effects of atropine and more sensitive to carotid sinus stimulation Electrocardiographic changes in the elderly show a general slight decrease in the voltage of the P QRS and T waves a slight prolongation of the P R QRS and S-T intervals and an increased tendency to notching and slurring of the QRS waves

As the result of a decrease in the elastic fibers of major arteries with increasing years the rate of the propagation of the arterial pulse wave increases gradually from about 6 meters per second at the age of 20 years to 8 meters per second at 60 years Also owing to changes in the structure and elasticity of the arteries there is a very gradual increase in systolic blood pressure which over the age of 40 years has been estimated at about 1 mm of mercury per year

CARDIAC ARREST

The sudden unexpected cessation of the patient s heart action during the course of

an operation is a possibility every surgeon is aware of and an experience, unfortunately, that many surgeons have had In The New York Hospital, cardiac arrest has occurred approximately once in every 1,300 operations If operations performed directly upon the heart are excluded, the incidence of cardiac arrest is decreased to 1 in every 1,800 operations

By definition, cardiac arrest is the sudden loss by the heart of its ability to propel the blood through the body with sufficient force to maintain life The term *cardiac arrest* is generally regarded as including two forms of arrest cardiac standstill and ventricular fibrillation In the former the heart is motionless and without electrical activity while in the latter many fasciculations can be seen or felt on the surface of the heart and the electrocardiogram has a characteristic irregular pattern Cardiac standstill as a primary occurrence is seen twice as often as ventricular fibrillation However, ventricular fibrillation often follows an initial period of standstill, occurring spontaneously in some cases and in others being triggered by cardiac messages or by the injection of epinephrine or calcium chloride From a practical standpoint, it is not necessary for the heart to be entirely motionless or free of electrical activity for clinical cardiac arrest to exist for the heart may continue to beat feebly with regular electrical activity on the electrocardiogram, and yet be incapable of propelling any significant amount of blood through the arteries Therefore one should not depend entirely on the electrocardiographic pattern for the diagnosis of cardiac arrest as clinical signs of the arrest may occur several minutes earlier Nor should the doctor feel that he has erred if he opens the chest as an emergency measure for cardiac arrest and finds the heart beating very feebly, for the patient under these circumstances is just as desperately in need of resuscitation as the one whose heart action has ceased entirely

There is evidence that the incidence of cardiac arrest in the aged is increasing A study of operating room deaths over a 30-year period at Massachusetts General Hospital showed that the percentage of cardiac arrest patients 50 years of age or older in the total group had risen from 48 per cent in the first 10 years of the study to 78 per cent in the last 10 years In the same hospital, in 1941, 30 2 per cent of all surgical patients were over 50 years of age and in 1954, 47 9 per cent were 50 or over Thus the increasing incidence of cardiac arrest in the older age group is due to the increase in the number of elderly patients undergoing surgery and to the fact that more extensive operative procedures are currently being done

The primary causes of cardiac arrest are as follows

1 Hypoxia anoxia
2 Vagal reflexes
3 Drug idiosyncrasy overdosage
4 Multiplicity of anesthetic agents
5 Hypercapnia blood pH changes
6 Hemorrhage
7 Loss of peripheral vascular tone
8 Direct stimulation
   (a) Cardiac catheterization
   (b) Left heart puncture percutaneous
   (c) Operative manipulation
9 Hypothermia
10 Coronary occlusion
11 Air embolism
12 Electrocution

Any of these may be a factor in causing cardiac arrest in the aged but in the older age group certain of these causes are of greater significance The general physical condition of the elderly patient coming to surgery may predispose toward cardiac arrest There may be hypovolemia which has developed slowly over a long period of time and which is not detected by the usual blood counts Thus when there is a decreased blood volume loss of even small amounts of blood is tolerated poorly the patient tends to go into shock more readily and once in shock the response to blood replacement is

not always satisfactory Preexisting coronary artery disease may come into play at this point With the decrease in systemic blood pressure, the flow of oxygenated blood through partially occluded coronary vessels is decreased to the extent that complete occlusion of the vessel occurs or dangerous arrhythmias develop owing to uneven oxygenation of the myocardium In the elderly patient probably the leading cause of sudden death in the operating room and in the immediate postoperative period is coronary artery disease

Hypoxia or anoxia even of very short duration is exceedingly dangerous in the elderly and may precipitate cardiac standstill or ventricular arrhythmias Thus, no matter how much of an emergency the surgical procedure may be in the older patient sufficient time should be allowed and adequate measures taken to insure that the stomach is empty before proceeding with the anesthesia Vomiting and aspiration of gastric contents is one of the most frequent causes of anoxia Hypoxia may result from preexisting chronic respiratory disease inadequate airway during or immediately following operation position of the patient on the operating table, or compression of the lungs during the procedure

The elderly patient is much more sensitive to sedative drugs and narcotics and there is no question but that many deaths in the operating room in older patients have been due to marked depressions from narcotics such as morphine or Demerol given preoperatively Also the elderly patient is quite sensitive to anesthetic agents and overdosage can occur more easily than in young persons The vagal reflex is not as active in the elderly patient as in children and young adults and therefore atropine is given in smaller doses and more cautiously in the older age patient Digitalis an important drug in preparing many patients for surgery can be exceedingly dangerous and toxic if overdosage occurs Rapid digitalization just prior to surgery can often cause digitalis toxicity especially if there are uncorrected electrolyte imbalances with abnormal blood potassium levels

Certain positions during operative procedures are not well tolerated in the elderly Often merely placing the anesthetized patient in the lateral position results in an immediate fall in blood pressure Moreover, when the cardiovascular system can function satisfactorily with the patient in the lateral position carbon dioxide tends to build up and there is a slow but steady fall in the blood pH At the conclusion of the operation when the patient is turned to the supine position and allowed to breathe room air the carbon dioxide is rapidly blown off and a rapid shift in blood pH occurs In experimental animals it is possible to cause ventricular fibrillation by such sudden shifts in blood pH and it is quite likely that this same mechanism may account for many cases of cardiac arrest that occur toward the end of an operation or shortly after the patient has been changed to the supine position and returned to breathing room air The Trendelenburg position in the elderly patient often causes respiratory difficulties and embarrassment of the cardiovascular system to the extent that it can be maintained only for short periods

Unexpected loss of peripheral vascular tone may take place in the patient during surgery and the usual methods of combating this condition may fail with cardiac arrest occurring as the terminal event The rather widespread use of corticosteroids for a variety of conditions which also occur with the process of aging makes this a hazard in the aged when the steroids have been stopped prior to surgery The patient is left with a relative adrenal exhaustion which can be corrected only by the administration of hydrocortisone If this is overlooked or neglected until the time of surgery it may be too late On the other hand there are certain antihypertensive and tranquilizing drugs which definitely should be discontinued prior to surgery lest disastrous loss of peripheral vascular tone develop after the induction of anesthesia Reserpine is the most dangerous

in this regard and should be discontinued for at least 2 weeks prior to surgery In every case both the surgeon and anesthetist should make every effort to ascertain what drugs the patient has been taking prior to coming to the hospital The patient may not always be reliable, and inquiries should be made of relatives and family doctors

Since the heart in the elderly person is more irritable and is subject to abnormal rhythms, it also tolerates any direct stimulation or manipulation less well and its recovery from such stimuli or handling is longer than that in the younger heart When hypothermia was first used clinically it was confined to children and young adults because it was thought that the young heart was less apt to develop ventricular fibrillation than the old heart As experience was gained with the use of hypothermia, however, its application was widened to include older patients Nevertheless there is still a general feeling that hypothermia is more dangerous in the old than in the young

Air embolism is rare and is no more apt to occur in the aged than in the young Although air can be sucked into a vein that is inadvertently opened at the base of the neck during an operation, it is more likely to be introduced accidentally into the veins in the course of administering blood under pressure Large amounts of air introduced into the veins will pass through the lungs and cause death by lodging in the coronary arteries so that the effect is the same as that of a coronary occlusion Obviously, prevention of this occurrence is paramount, but it is possible successfully to resuscitate the heart under these circumstances by acting rapidly, turning the patient on the left side aspirating the air from the right side of the heart and massaging the heart to force the air through the coronary arteries From this point on resuscitation is the same as for any other type of cardiac arrest

So far the discussion has been concerned with that form of cardiac arrest which is associated with an operation The arrest occurs during the induction of the anesthesia, during the course of the operation, at the conclusion of the procedure or during the early postoperative period in the recovery room This is the type of cardiac arrest with which most physicians are familiar As diagnostic procedures become more complex, cardiac arrest is encountered more frequently in the course of such procedures as bronchoscopy, cardiac catheterization, and retrograde aortography Moreover, only recently it has been recognized that there is a type of cardiac arrest which occurs spontaneously so to speak, in the absence of any operative diagnostic or therapeutic procedure The following case history is an example of this type of cardiac arrest

CASE REPORT C B (N Y H No 182944)

A 67 year old white male house painter came to the emergency room of The New York Hospital early one morning complaining of precordial pains While undressing to be examined he collapsed and was found by the nurse unconscious on the floor A few minutes later he was seen by the assistant resident surgeon who could feel no carotid pulse and could hear no heart sounds at this moment respirations ceased The patient was lifted from the floor to a bed and the chest was opened through the left fifth intercostal space The heart was in standstill and intermittent cardiac compression was begun through the intact pericardium At the same time oxygen by mask was given by the medical assistant resident As cardiac massage was continued additional help was obtained from the resident surgical staff who took turns massaging the heart An endotracheal tube was inserted and the lungs were inflated under positive pressure with oxygen from an anesthesia machine Spontaneous respiration returned 5 minutes after cardiac massage was begun Blood was drawn for typing and cross matching and 5 per cent dextrose in water was given intravenously until blood was available for transfusion With each compression of the heart a carotid pulse could be felt and the patient began to move his arms about

However after 30 minutes of very effective intermittent cardiac compression the heart was still flabby and in standstill Epinephrine 0 5 cc of a 1 1 000 solution

was injected into the cavity of the left ventricle and massage was continued Ventricular fibrillation developed and was abolished by electrical countershock Feeble contractions began Ten per cent calcium chloride 5 cc was injected into the left ventricle and again ventricular fibrillation developed Electrical defibrillation was accomplished and 5 cc of 10 per cent calcium chloride was given to strengthen the feeble contractions Although the force of the contraction was increased temporarily the heart stopped for the third time When continued cardiac massage was ineffective 0 5 cc of 1 1 000 epinephrine was injected as before and following the same pattern ventricular fibrillation occurred Six shocks 185 volts at 0 02 second duration were required to defibrillate but this time the heart began to beat regularly and forcefully Cardiac massage had been continued for a period of 1 hour and 12 minutes

When the peripheral pulses were good and strong and heart action was regular he was moved to an adjoining minor surgery operating room where the chest wound was cleansed and draped for closure Special care was taken to be certain that there was no bleeding from internal mammary vessels One million units of penicillin and 1 Gm of dihydrostreptomycin were placed in the pleural cavity which was drained and connected to a water sealed suction device Chromic catgut was used for the closure and the subcutaneous tissue was drained by a Penrose drain which was removed on the third postoperative day During the closure the patient struggled and moved about so much that he was given 8 mg of morphine intravenously The pupils which had been moderately dilated until this time now became contracted He was transferred to the recovery room and placed in an oxygen tent

His course for the next few days was a stormy one His electrocardiographic pattern was followed continuously on the screen of a cardioscope in conjunction with a cardiac monitor Serial electrocardiograms showed T wave changes compatible with a coronary occlusion but which could also have been due to the prolonged cardiac massage and to digitalis effect An intravenous norepinephrine drip was required for 3 days to maintain the blood pressure and a satisfactory urinary output Within 36 hours of the cardiac arrest he was mentally alert and oriented as to time and place The thoracotomy wound healed without gross infection Because it was suspected that he had had a coronary occlusion he was kept in bed for 3 weeks and then gradually mobilized A psychiatrist found no evidence of gross organic brain damage He was discharged from the hospital 33 days after admission Six months later he was working part time

In addition to this case seven other cases of successful resuscitation after cardiac arrest due to coronary occlusion have been reported in the literature These include a 65 year old physician reported by Beck who was successfully resuscitated after cardiac arrest in the emergency room of a Cleveland hospital In all eight cases the arrest took place in some part of a hospital other than the operating room or recovery room This indicates that, under circumstances somewhat less than ideal it is possible for a significant number of patients who die after a coronary occlusion to be resuscitated and returned to useful life As Beck explained this is possible because many patients who die of coronary occlusions succumb not because the heart cannot get enough oxygenated blood, but because sudden changes in the coronary circulation produce a difference in electrical potential between the areas of the myocardium unevenly supplied with oxygenated blood This difference in electrical potential sets off abnormal and ventricular fibrillatory rhythms which may be abolished with the proper course of action

There follows an outline of the course of action to be followed for the successful resuscitation of a patient from cardiac arrest

I Early diagnosis (by anesthetist surgeon physician or nurse)
  A Absent carotid pulse
  B Absent heart sounds
  C No respirations
  D Cardiac monitor

II Immediate action (over 4 minute delay is fatal)

III Heart
  A Sharp blow to precordium
  B Thoracotomy, left 4th or 5th intercostal space
  C Intermittent cardiac compression
IV Lungs
  A Mouth to mouth respiration
  B Oxygen mask
  C Tracheal intubation
V Cardiac standstill
  A Continued massage
  B Epinephrine 1 10,000
  C Calcium chloride, 10 per cent
  D Isuprel 1 μg per kg
  E Artificial pacemaker
VI Ventricular fibrillation
  A Electrical defibrillation
  B Epinephrine procaine
  C Potassium citrate
VII General measures
  A Intravenous fluid whole blood
  B Trendelenburg position
  C Occlusion of thoracic aorta
VIII Hypothermia (For central nervous system damage)

Regardless of whether the arrest takes place in the operating room, recovery room, accident pavilion or elsewhere in the hospital, the same general principles apply Early diagnosis is extremely important In the operating room it is the anesthetist who usually detects the first signs of cardiac arrest and he should inform the surgeon immediately The surgeon in most cases is working in an area of the body where he can palpate a major artery and confirm the absence of pulses or he can feel for the heart beats through the diaphragm if he is working in the upper portion of the abdomen There are some cases however, when this is difficult an example of this is the elderly patient undergoing an eye operation Since the procedure is done under local anesthesia there may not be an anesthetist in attendance The patient is covered with drapes except for the eye and as one would expect the diagnosis of a cardiac arrest under such circumstances is often delayed An electrical cardiac monitoring device is most useful in this type of situation A number of such monitors are commercially available and are equipped with visual and auditory means for detecting cardiac standstill or ventricular fibrillation in the operating room If a competent anesthetist is present during the operation such a monitoring device is not necessary, although on certain poor risk patients and on all cardiac operations a continuous electrocardiogram on the screen of a cardioscope is most helpful in the anesthetic management

The diagnosis of cardiac arrest outside of the operating room must be made by whoever is with the patient at the time of the catastrophe This may be an attending doctor a house officer, a nurse or a nurse's aide Time must not be wasted in applying or adjusting a blood pressure cuff or even in taking the blood pressure if the cuff is in place Of course an electrocardiograph would help to establish the diagnosis if a direct writer just happened to be connected and running at the time of the arrest but this is seldom the case If there are no carotid pulses and no heart sounds and especially if the patient is not breathing or gives only an occasional gasp resuscitative measures must be taken immediately Resuscitation cannot be carried out successfully by one person so if only one nurse or doctor is present, additional help should be summoned at the first sign of difficulty

At the present time only doctors are qualified to open the chest and massage the heart However nurses and other personnel may be assigned to tasks that are equally important and that must be carried out simultaneously with the opening of the chest Thus at the first signs of respiratory failure the lungs must be inflated artificially First the airway must be clear Then oxygen is given by a tight fitting mask if it is available If the arrest occurs in an area where no oxygen is immediately available, mouth to mouth breathing is the most effective means of inflating the lungs A special plastic disposable airway (Fig 11-1) which greatly facilitates

mouth to mouth breathing is now available By reversing the ends, it may be used either on adults or children (Fig 11 2*A*) These airways should be readily available in the accident room recovery room all pavilions throughout the hospital and all the various outpatient clinics There should also be one in every doctor s bag The most efficient method of artificially ventilating the lungs is through endotracheal intubation and positive pressure breathing with an anesthesia machine but this refinement usually comes later when resuscitation is well under way If only a nurse and doctor are present when arrest occurs the former may give oxygen by mask or carry out mouth to-mouth breathing (Fig 11 2) while the latter directs his attention to the heart

Before the doctor opens the chest it may be worthwhile to take an extra 10 seconds to give a sharp thump on the chest over the heart In some cases when the heart is in standstill this simple maneuver will start it making a thoracotomy unnecessary Such a heart also may be started by the prick of a needle in the days when it was popular to inject epinephrine percutaneously into the arrested heart it was probably the prick of the needle that accounted for success as much as the epinephrine Such thumping of

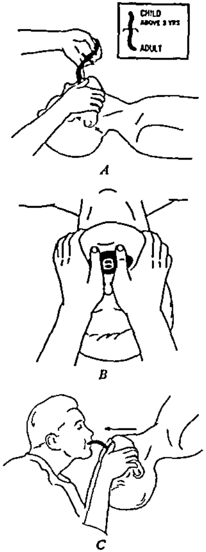


Fig 11 2 Steps in the use of plastic airway for mouth to mouth breathing *A* Step 1 insert the breathing tube *B* Step 2 hold lower jaw forward keep head extended (front of neck stretched) prevent air leakage *C* Step 3 blow into tube

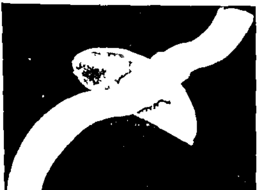


Fig 11 1 Plastic airway for mouth to mouth resuscitation It may be used on adults or children depending upon which end is inserted This model was made by Johnson & Johnson New Brunswick N J

the precordium should not delay the thoracotomy more than 15 to 30 seconds if it is not successful

The emergency thoracotomy for exposing the heart is done without the benefit of any skin preparation or rubber gloves Only one surgical instrument is necessary and that is a scalpel Even a pocketknife has served well when nothing else was at hand The incision is made parallel to the ribs below the breast on the left so as to enter the fourth or fifth

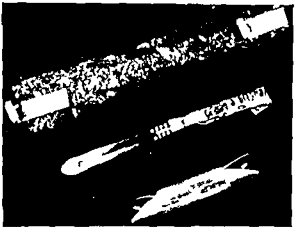


Fig 11 3 Cardiac arrest kit A 10-cm long tube of aluminum with a notch in each end serves as a simple rib spreader When it is placed between the fourth and fifth ribs there is adequate exposure and the wrist of the doctor performing the massage is not pinched by the ribs A Bard Parker knife handle with blade attached but protected by aluminum foil is placed within the lumen of the rib spreader and both are enclosed in a cellophane tube The entire package is autoclaved It makes a small compact kit which may be carried in a doctor s pocket

intercostal space The fact that there is little or no bleeding as one cuts through the skin and subcutaneous tissue is confirmatory evidence that the heart has stopped Frequently in the haste of cutting through the intercostal muscle the lung is nicked but this may be avoided by exercising a little caution at this stage The incision through the intercostal muscles must extend from the sternal border to the midaxillary line To prevent the ribs from pinching the doctor s wrist as he inserts his hand into the thorax a small tubular aluminum retractor with fish mouth ends (Fig 11 3) is inserted between the ribs Without opening the pericardium intermittent cardiac compression at a rate of 60 to 70 per minute is begun

The doctor compressing the heart stands to the patient s left and with his right hand grasps the heart with the four fingers beneath (posterior) and the thumb on top of the heart (anterior) This will serve for small or average sized hearts Enlarged hearts may be more effectively compressed by pressing the heart forward against the sternum or by squeezing it between two hands, one in front and one behind If the compression is effective, a pulse can be palpated in the neck or at the wrist This intermittent compression (or massage, as it is commonly, if not correctly called) at the rate required is quite tiring and for continual effective massage it is necessary for several doctors to take turns The pericardium is not opened for the first 5 minutes because in many cases of cardiac standstill the heart will start readily after only a minute or two of massage and opening the pericardium will be unnecessary But if the heart has not shown any signs of starting to beat after 5 minutes of massage one of two situations exists (1) A more resistant form of standstill is present and it may be necessary to inject certain drugs into the left ventricle so that these can be massaged into the coronary vessels These drugs should be injected with the pericardium opened so that coronary vessels can be avoided (2) A very fine ventricular fibrillation may be present though invisible through the intact pericardium If this is the case, the treatment of choice is electrical defibrillation Nothing will have been lost by the 5 minutes of massage In fact electrical defibrillation should never be attempted unless preceded by a few minutes of massage so that the color and tone of the heart are improved It is very difficult to defibrillate a cyanotic flabby heart

If standstill continues, 2 to 4 cc of a 1 10,000 dilution of epinephrine injected into the chamber of the left ventricle and massaged into the coronary arteries will improve the tone of a flabby heart and often this will initiate heartbeats Just about as often though ventricular fibrillation develops and this may be treated with electrical defibrillation A pink heart that is firm with coarse fibrillations can be more easily started than a flabby cyanotic motionless heart Isopropylnorepinephrine (Isuprel), 1 μg per kg of body weight (the usual ampule for intravenous use contains 200 μg in 1 cc) in theory at least should be just as effective

as epinephrine and should be less likely to produce ventricular fibrillation than epinephrine However in the authors hands Isuprel has not been as effective clinically as epinephrine Calcium chloride 3 to 4 cc of a 10 per cent solution injected in the same manner will sometimes prove effective in starting the heart when epinephrine and Isuprel have failed This is more apt to be the case when large amounts of citrated blood have been given during an operation and no calcium given previously In the authors experience calcium chloride has been most effective when given to a heart that is beating but beating so feebly that little or no blood is being pumped Very often under these circumstances the intensity of the contractions increases and normal sinus rhythm with good heart action continues Probably just as often though calcium chloride will throw such a feebly beating heart into ventricular fibrillation

Artificial pacemakers for external stimulation of the heart are very successful in cases of Stokes Adams syndrome and excellent results have been reported by Zoll and others in the treatment of cardiac standstill At The New York Hospital the authors have not been enthusiastic about their use feeling that considerable time may be wasted in placing the electrodes and that if this method fails it may be too late for massage The authors have been only moderately successful in using a pacemaker with the electrodes applied directly to the heart In a number of cases it has been found that, although the ventricles did respond to each stimulus the strength of each systole was not sufficient to force much blood out of the heart so that even though the heart seemed to be beating and following the pacemaker the output was extremely low and there were no peripheral pulses Therefore if one uses a cardiac pacemaker with the electrodes applied directly to the heart one must watch the pulses carefully and resort to cardiac massage if necessary Recently a new type of battery driven transistorized pacemaker has become available Used chiefly thus far to overcome surgically induced heart block in open heart surgery performed on young patients it may have an application in certain types of cardiac arrest in the elderly e g the patient with Stokes Adams syndrome who is subjected to thoracotomy to restart the heart and in whom fine wires could be left attached to the myocardium to be connected to the transistor pacemaker

If ventricular fibrillation is present when the heart is first exposed or develops later after massage or the administration of drugs electrical defibrillation must be done The heart should be massaged for at least 3 minutes prior to the application of the electrodes which should be padded and moistened with saline One electrode is placed behind the heart and another over the ventricle anteriorly Two or three shocks in rapid succession are usually more effective than a single shock In the older heart one should start with a voltage of 220 to 250 at 0 1 second duration If this is not successful massage should be continued for several minutes and the countershocks repeated In greatly enlarged hearts the authors have advanced the voltage to as high as 350 volts at 0 02 second duration with successful defibrillation when lower voltages had failed They feel that if voltages of over 250 are used the duration of the shock should be reduced to 0 02 second to minimize burns to the myocardium A flabby heart that is resistant to defibrillation may have its tone improved by epinephrine, so that electrical defibrillations can be more readily accomplished Sometimes a mixture of epinephrine with 8 to 10 cc of 1 per cent procaine is recommended when ventricular fibrillation tends to recess but the procaine may depress heart action once normal sinus rhythm has been established and should be avoided if possible Potassium in the form of chloride or citrate has been used to change ventricular fibrillation into standstill Its use in most cases has been confined to situations where an electrical defibrillator could not be obtained or in conjunction with open heart surgery

Certain general measures are fairly obvious A moderate degree of Trendelenburg position provides more blood to the vital cerebral centers Temporary occlusion of the aorta distal to the carotid vessels serves the same purpose but is not always technically easy through a limited thoracotomy, unless care *is taken intercostal arteries may be* torn Blood should be given intravenously as soon as possible to aid in the filling of the heart and to make up for the blood lost at *thoracotomy* Again care must be taken not to overtransfuse the elderly patient and cause pulmonary edema In closing the thoracotomy wound all bleeding vessels should be ligated especially the internal mammary artery the severance of which may go unnoticed The left pleural cavity is always drained Antibiotics are given It is advisable to use absorbable suture material to avoid draining silk sinuses

It is a well known fact that the heart can be *resuscitated long after irreversible damage* has been done to the central nervous system Many surgeons have seen a patient whose resuscitation for cardiac arrest at first seemed successful but who never regained consciousness and died several days later with extensive cerebral damage Spencer has reported that hypothermia may help such patients When the interval between the onset of cardiac arrest and the start of cardiac massage is longer than 4 minutes there is still hope for the patient provided he is cooled to about 32°C immediately and kept at this temperature for 2 or 3 days The cooling process is believed to reduce cerebral swelling and to minimize brain damage

WOUNDS OF THE HEART AND GREAT VESSELS

Stab wounds and gunshot injuries of the heart and great vessels are seen more frequently in civilian life in young vigorous persons However in the larger metropolitan areas the elderly person is certainly not immune to robbery rape and mugging and from time to time penetrating wounds of the chest with cardiac involvement will be seen in old persons Also nonpenetrating injuries of the heart and great vessels will be encountered following automobile accidents as long as our aging population continues to travel by automobile

The patient who survives a wound of the *heart long enough to reach the hospital does* so because of the beneficial effect of pericardial tamponade which prevents fatal exsanguination But pericardial tamponade is a two edged sword and although it prevents severe hemorrhage, it reduces the ability of the heart to fill properly and thus drastically reduces cardiac output So the patient arrives in the emergency room in a state of shock with muffled distant heart sounds and unless blood loss has been great an elevated venous pressure—a state that the elderly patient can tolerate only very briefly if at all Examination and treatment must be rapid

When the diagnosis of pericardial tamponade has been made on the basis of the history nature of the injury and physical findings pericardiocentesis should be done *immediately Simultaneously,* intravenous fluid and blood when available should be started Although improving the diastolic filling of the heart by rapid transfusion with an increase in *venous pressure is one means* of combating cardiac tamponade one must be careful in the elderly patient not to overtransfuse and cause fatal pulmonary edema

In general there have *been two schools* of thought in the treatment of cardiac wounds There are those who feel that the lowest mortality will be obtained from pericardiocentesis alone repeated several times if necessary, and there are those who feel *that pericardiocentesis* is not enough and that thoracotomy with suture of the wound is a more effective method *Probably an intelligent* use of both methods is ideal

In the emergency room the *aspiration* of as little as 10 cc of blood has resulted in dramatic improvement in *the patient* If such improvement occurs *fine and* good but he should be taken to the operating room

and prepared for thoracotomy If his condition permits an x ray film of the chest may be taken on the way to the operating room or a portable film may be taken after he is on the operating table When all preparations have been made for the thoracotomy, surgical judgment must come into play and many factors must be taken into consideration The surgeon must decide on the next course of action If the general condition is good following the original pericardiocentesis the surgeon may elect to watch the patient for a time on the operating table and to open the chest only if he starts to deteriorate He might even try one or more pericardiocenteses before opening the chest If the patient is still moribund on reaching the operating room it may be quite apparent that exposing the heart as quickly as possible is the only hope of saving the patient and this is done very much in the same manner as for cardiac arrest The patient who is only moderately improved after aspiration of the pericardium is the one whose treatment taxes the surgeon's judgment Here careful consideration must be given to a number of factors The age of the patient and his general condition aside from the injury must be considered The type of injury the weapon used and the possible site of the injury based on the point of entry and x ray finding may influence the decision The general tendency in The New York Hospital–Cornell Medical Center definitely leans toward exploration under light ether anesthesia if this seems at all feasible so that the wound can be evaluated and closed and both the pericardium and pleural cavity drained

Patients with penetrating wounds of the aorta and pulmonary artery unless these occur in the portion of these vessels within the pericardium are less apt to reach the hospital alive Certainly any wound suspected of involving the great vessels should be operated upon immediately Blunt or indirect trauma sometimes may lead to disruption of all but the adventitial layer of the aorta Rupture of the adventitia may be delayed for several days Thus exploration of the chest is advisable if a partial tear of the aorta is suspected in the presence of severe nonpenetrating trauma and widening mediastinum on chest x ray

CARDIAC TUMORS

Primary neoplasm of the heart occurs rarely, and only about 500 cases have been recorded Myxoma of the heart is the most common type and comprises 50 per cent of all primary cardiac tumors Other primary tumors of the heart in order of their frequency are sarcoma rhabdomyoma lipoma angioma hemangiosarcoma and intrapericardial bronchogenic cyst

The intracavitary myxoma is of considerable interest to the surgeon Until a few years ago these tumors were regarded as pathologic curiosities but since hypothermia and extracorporeal circulation have made open heart surgery possible more and more case reports of their successful removal are appearing in the literature Although the age range is 3 months to 68 years the majority occur between the thirtieth and sixtieth year of life and about one third of the successfully surgically treated patients have been over 50

At one time it was thought that these myxomas might be organized thrombi that had undergone myxomatous degeneration but most authorities now regard them as true primary tumors They occur almost entirely within the atria and 75 per cent are located in the left atrium They are nearly always polypoid and the pedicle of those in the left atrium usually arises from the atrial septum in the vicinity of the foramen ovale These are features that greatly facilitate their surgical removal

Clinically the pedunculated myxoma of the left atrium resembles rheumatic mitral stenosis In fact many of these tumors have been discovered at operation when the surgeon inserted his finger into the left atrium to fracture the mitral valve and found to his surprise a polypoid tumor and a normal mitral valve A careful history will bring out

certain features which help to differentiate between the two Usually there is no history of acute rheumatic fever in patients with myxoma The symptoms of dyspnea and fatigue are similar in the two conditions, but the progress of the disease is more rapid with tumors If symptoms such as acute dyspnea, precordial pain dizziness or fainting occur with changes in body position, as in bending over or lying on one side one should be alerted to the possibility of an intraatrial tumor The murmur produced by a myxoma of the left atrium may mimic exactly the rumbling presystolic murmur of mitral stenosis and an opening snap also has been reported Systemic emboli may occur in both conditions, and occasionally the diagnosis can be made from the microscopic examination when such embolic material can be recovered Actual fragments of the tumors break off and have a typical microscopic appearance The ordinary x ray films of the chest and electrocardiograms are of little help in the differential diagnosis Myxomas of the right atrium may obstruct the inflow tract of the atrium or the tricuspid valve and have been confused with constrictive pericarditis and tricuspid atresia of rheumatic origin Cardiac catheterization may indicate the presence of a tumor in the right atrium Angiocardiography will confirm the diagnosis of a tumor in either atrium although sometimes it is difficult to distinguish between a clot and a myxoma in the left atrium

Whether the diagnosis is made in the course of performing an exploratory cardiotomy for erroneously diagnosed mitral stenosis or by an astute clinician with angiocardiographic confirmation, the treatment is the same In the first situation no attempt should be made to remove the tumor by closed methods The operation should be concluded and the tumor removed at a later date when suitable preparations have been made Although a number of these tumors have been successfully removed with the aid of hypothermia few surgeons would use this technique today Unquestionably these are to be attacked most readily with extracorporeal circulation by means of a pump oxygenator The removal can then be an unhurried process with less danger of fragmentation of the tumor and embolization

CONGENITAL CARDIAC DEFECTS

One might think that a discussion of congenital cardiac defects has no place in the consideration of cardiac surgery in the aged and for the most part this is true Certain congenital anomalies of the heart are of such a nature that the patient rarely survives infancy or early childhood i e truncus arteriosus transposition of the great vessels and ventricular septal defects In the case of defects such as coarctation of the aorta patent ductus arteriosus tetralogy of Fallot pulmonic stenosis or aortic stenosis the patient usually died before old age was reached as a result of recent advances, the trend is to correct the defect surgically prior to old age However there are some exceptions and these are worthy of mention

Not all patients with patent ductus arteriosus who are untreated surgically succumb to subacute bacterial endocarditis heart failure, pulmonary arterial hypertension or rupture of aneurysm of the ductus In the autopsy files there are reports on three patients over 80 with patent ductus arteriosus The ductus in such patients is usually not very large About 85 per cent of operations for patent ductus arteriosus are done in children Occasionally because of increasing fatigue rather than frank heart failure a patient in the forties or early fifties may be subjected to obliteration of the ductus At The New York Hospital the oldest patient to undergo a successful operation for patent ductus arteriosus was 41 years One patient 53 years old with a reversal of flow through the ductus has been reported Operation at any age when the flow is predominantly right to left is seldom successful

It is said that 60 per cent of patients with coarctation of the aorta are dead before they reach the age of 40 and although no definite age limit for surgery has been set, the hazards

of operation increase considerably in groups above 40 At The New York Hospital–Cornell Medical Center the oldest patient successfully operated on for coarctation of the aorta was 51 The chief danger of operation in the older patient is disruption of the suture line because of thinning out and atheromatous changes in the wall of the aorta usually that portion distal to the coarctation The lowering of the blood pressure in the upper extremities very often is not satisfactory in these older patients even though an adequate lumen is obtained at the site of the coarctation This poor response to surgery is probably due to secondary renal changes which are irreversible Gross has reported a case of complete flaccid paraplegia in a 50-year-old patient following resection of a coarctation The incidence of spinal cord damage is probably not related to the age of the patient but is inversely proportional to the extensiveness of collateral circulation the length of time of occlusion of the aorta is also a factor

Uncomplicated atrial septal defects of the secundum type cause few symptoms in childhood and even though many of the patients with this defect have serious trouble in young adult life a few survivors are seen after the age of 50 Lewis has operated on five patients with atrial septal defects who were over 50 and his oldest patient who survived surgery was 61 At The New York Hospital a large atrial septal defect was successfully closed in a woman of 55 with use of a pump oxygenator Age is no contraindication to surgery in atrial septal defects provided the shunt is predominantly left to right Very large shunts are seen in these patients the volumes are much greater than in ventricular septal defects However pulmonary vascular resistance increases more slowly in atrial septal defects than in ventricular septal defects which accounts for the fact that there are no ventricular septal defects for repair in the aged Once pulmonary vascular resistance has increased to the extent that the interatrial shunt is reversed and is from right to left operation is contraindicated no matter what the patient s age Atrial septal defects may be successfully closed using hypothermia or a Gross well but since total body perfusion with pump oxygenator has become reasonably safe the latter is the preferable technique Special care should be taken not to overtransfuse these patients Thromboses in the pulmonary arteries have led some surgeons to the routine postoperative use of anticoagulants

CONSTRICTIVE PERICARDITIS

Pericardiectomy for constrictive pericarditis was one of the first operative procedures to be performed on the heart In this country it was first successfully done by Churchill in 1929 Although the cause of constrictive pericarditis is generally considered to be tuberculosis it has been difficult in most cases to demonstrate the tubercles by microscopic examination or culture of the tissue removed during operation in about three-quarters of the cases the pathologist makes a diagnosis of chronic nonspecific pericarditis

Constrictive pericarditis occurs twice as frequently in men as in women It is more commonly seen in patients below the age of 50 but in every reported series there are a few patients over this age and usually some in their sixties In 72 operative cases reported by Cooley from the Mayo Clinic there were 10 patients between the ages of 50 and 64 At The New York Hospital pericardiectomy has been done on 6 patients between the ages of 50 and 55 Among these 6 there was one death which occurred on the tenth postoperative day due to myocardial failure Holman reported on 26 patients who had had pericardiectomy for constrictive pericarditis and among these there were 6 whose ages ranged between 50 and 63 years Of these 6 patients 3 died of cardiac failure in the immediate postoperative period 3 survived Two of the survivors were well but 1 was not improved and in mild cardiac failure Holman believes that even though the hazards of pericardiectomy increase with age it is no contraindication to surgery

Patients with chronic constrictive pericarditis complain of dyspnea, right upper quadrant pain, abdominal swelling, ankle edema and weakness. The systemic venous pressure is elevated and there is a paradoxical pulse. On x-ray and fluoroscopic examination the heart is either small or only slightly enlarged and the pulsations are diminished. Calcifications are seen in the pericardium in only about 50 per cent of the cases. Cardiac catheterization, although not necessary to confirm the diagnosis in all cases, is helpful in distinguishing borderline cases of myocardial failure from constrictive pericarditis.

The operation was originally performed by resection of several costal cartilages to the left of the sternum, but currently sternal splitting or sternal transecting approaches are used. When both ventricles are involved, the left ventricle is decorticated first and then the right. Although Holman has stated that in order to be effective the decortication must be carried to both the inferior and the superior vena cava, others feel that it is not always necessary to extend the resection over the right atrium to these structures in order to achieve a good result.

VALVULAR HEART DISEASE

The valve most frequently damaged by rheumatic fever is the mitral valve. This is a fortunate occurrence, of all acquired valvular diseases it is most effectively treated surgically. At first clinicians were reluctant to refer patients with mitral stenosis over the age of 50 for operations. By the same token surgeons were somewhat reluctant to operate on the mitral stenosis patient over 50. This is reflected in the series of operations performed on patients with mitral stenosis at The New York Hospital which totals over 400 (Table 11.1). It will be noted that in the first 100 operations there were only 5 patients over the age of 50 and in the second 100 there were only 9. In the third and fourth 100 cases the number of patients over 50 years of age increased to 21 and 24 respectively. So there has been a total of 59 patients over 50 years of age who have been subjected to mitral valvulotomy. Twenty-three of these were 55 or over, and 2 were over 60. The oldest patient in the series was 63 and he has had an excellent result.

TABLE 11.1. FOUR HUNDRED OPERATIONS PERFORMED FOR MITRAL STENOSIS*

	No. of patients over 50 yr of age	Deat
1st 100 cases	5	0
2d 100 cases	9	0
3d 100 cases	21	0
4th 100 cases	21	3
Total	59	3 (5.1%)

* The New York Hospital–Cornell Medical Center.

† Operative mortality for patients under 50 yr 5.8%.

In the first 300 patients to undergo mitral valvulotomy, 35 were over the age of 50 and in this group there were no operative or postoperative deaths. Three deaths occurred in the group of 24 patients over 50 years of age in the fourth 100 patients operated on. One woman aged 50 could not be resuscitated from cardiac arrest which followed hemorrhage from a tear in the left atrium. This patient had considerable aortic stenosis and insufficiency and was a poor risk candidate for mitral valve surgery. Another woman aged 53 who gave no history of emboli had a large clot in the left atrium. The brain was protected from emboli by external carotid pressure while the clot was removed. Nevertheless the patient had signs of a saddle embolus at the conclusion of the mitral operation. She was improved af[ter] embolectomy and was given anticoagulati[on] therapy. On her seventh postoperative da[y] she died after a massive hemorrhage from the gastrointestinal tract. Autopsy showed multiple gastric ulcers. Another patient, a 55-year-old man with mitral stenosis, mitral insufficiency and a huge left atrium died in a state of shock 2 days after operation.

Autopsy revealed an infarction of the entire small bowel There were no clots in the atrium but the valve was calcified and there was marked regurgitation

One can see that age was really not much of a factor in the deaths of these three patients In the first and last case the patients were not good candidates for surgery because of associated aortic valve disease and marked mitral regurgitation respectively The second case where death was due indirectly to clots in the atrium illustrates perhaps the most serious hazard to mitral surgery today regardless of the age of the patient clots in the atrium

If one compares the operative mortality of those patients under 50 (5 8 per cent) with those over 50 (5 1 per cent) there is no significant difference The results of mitral valvulotomy (Table 11 2) are not quite so good for the patients over 50 as for those under 50 but there is not a great difference Seventy one per cent under 50 are markedly or moderately improved Sixty three per cent over 50 are markedly or moderately improved

Harken recently has reported on his experience with a series of 154 patients over the age of 50 taken from a series of 1 000 operations for mitral stenosis He found that a higher percentage of the older patients were in group IV and that preoperative arterial embolization associated arteriosclerotic heart disease and hypertension were

TABLE 11 2 RESULTS OF MITRAL VALVULOTOMY IN 400 PATIENTS *

	Patients under 50 follow-up on 1st 100 operations	Patients over 50 follow-up on 1st 300 operations
Marked improvement	41%	34%
Moderate improvement	30%	29%
No change	17	34%
Made worse	12	3

* The New York Hospital–Cornell Medical Center

more common in the group over 50 Nevertheless he found that the operative risk incidence of late deaths and percentage of improvement after operation were practically identical in the two groups Therefore advanced age per se is no contraindication to the surgical correction of mitral stenosis provided the patient fulfills the usual criteria for operability on the mitral valve

On the other hand Bailey's group reported 45 patients above the age of 55 years in a series of 1,561 operations for mitral stenosis Their oldest patient was 61 There were six deaths for an operative mortality of 13 3 per cent All these deaths were attributed to cardiac arrest In the follow up period which ranged from 6 months to 5 years there were six or 18 8 per cent deaths Of the survivors 19, or 73 per cent, were clinically improved Six were unchanged and 1 was made worse Uricchio, reporting this experience felt that because of the added risk involved the older patient represents a particular problem in selection and preparation for mitral commissurotomy

At the present state of our knowledge and experience predominant mitral insufficiency is a definite contraindication to surgery on the mitral valve in the older patient The various types of closed operation for mitral insufficiency have not been very successful even in young patients and should not be attempted on the elderly Open operations for mitral insufficiency are presently being attempted using the pump oxygenator but until these techniques have been properly evaluated they should not be tried on the elderly patient

Acquired aortic stenosis is seen about three times as frequently in men as in women Rheumatic fever is the most common cause but calcifications may develop on congenital bicuspid aortic valves late in life There is some evidence that calcific aortic stenosis may be the late effect of brucellosis infection with brucellar endocarditis In any case the onset of the disease is insidious and symptoms do not appear until it is fairly well advanced This is because the left ventricle

can hypertrophy, develop a higher pressure during systole, and compensate for gradually decreasing aortic valve opening The long-term follow up studies on unoperated patients have shown that symptoms appeared first at an average age of 47 The mean survival time was only 9 years after the onset of symptoms About one half the patients developed angina, and the average survival time after this appeared was 5 years In the one fifth of the patients who had syncope death followed in an average of 3 years Thus it is quite obvious that, once symptoms develop in aortic stenosis, the course is rapidly downhill and death occurs most commonly in the middle or late fifties

In general the experience with the surgical treatment of acquired aortic stenosis has not been nearly as gratifying as that with mitral stenosis The operative mortality has been higher and the results have been poorer Older patients with aortic stenosis are more apt to have coronary atherosclerosis and this considerably increases the risk of operation On the other hand, coronary atherosclerosis can be associated with a calcific but nonstenotic aortic valve and clinically closely resembles aortic stenosis In many instances it may be difficult to rule out coronary atherosclerosis in older patients and the degree of aortic stenosis should be evaluated by the left heart catheterization

At The New York Hospital calcific aortic stenosis has been treated surgically a number of ways The oldest patient to survive surgery was 57 Her valve was opened through the transventricular route by means of an expanding valvulotome a method now abandoned However some surgeons are reporting excellent results from the use of a new slender expanding valvulotome inserted through the left ventricle Hypothermia would seem to have no place in the direct approach to the aortic valve in elderly patients because of the danger of ventricular fibrillation Some surgeons still prefer to open the stenosed aortic valve digitally through a diverticulum sewed to the wall of the ascending aorta At the present time at The New York Hospital–Cornell Medical Center the most satisfactory method of dealing with the stenosed aortic valve is by direct exposure using the pump oxygenator and potassium citrate arrest The oldest patient treated by this technique was 50 and she has been greatly improved Cooley reports having successfully operated on a 65 year old man with calcific aortic stenosis with use of a pump oxygenator

Ideally, aortic stenosis should be treated before the patient reaches old age but when patients in their late fifties are seen operation may be offered, provided that there is a significant gradient over the aortic valve on left heart catheterization and that there is no severe coronary artery disease minimal aortic regurgitation and no intractable left heart failure

Regurgitation through the aortic valve may be the result of rheumatic fever syphilis or trauma or it may be present as a feature of Marfan s syndrome Aortic insufficiency may be present for many years with little in the way of symptoms but once symptoms have begun, the disease may run a rapid course This is especially true of aortic insufficiency due to syphilis where the progress of the disease is almost twice as rapid as in that due to rheumatic fever

The plastic ball valve of Hufnagel has been the most widely employed means of partially correcting the regurgitation through the aortic valve It is estimated that this reduces the load on the left ventricle by 75 per cent Even so there are not many reports of its successful use in patients over the age of 50 Efforts toward correction of aortic insufficiency by placing circumcluding sutures about the base of the aorta have not been encouraging Various methods of overcoming aortic regurgitation by placing plastic valves in the aorta below the coronary ostia and by placing ball valves in prostheses between the apex of the heart and the descending aorta are in the experimental stages they must be worked out in the laboratory and

tried in young patients before they can be applied to older ones

CORONARY ARTERY DISEASE

In our population coronary artery disease is one of the greatest problems medical science faces today It is seen with twice the frequency of rheumatic heart disease and is thirty times as frequent as congenital forms of heart disease As the proportion and actual number of elder citizens increases so will there be an even greater increase in the number of patients afflicted with this condition

The problem of coronary arteriosclerosis and its treatment by operative means has offered a tantalizing challenge to the surgical investigator and the course of investigation has followed a number of different patterns Since the basic difficulty in coronary artery disease is a decrease in blood supply, virtually all methods strive to overcome this by bringing more blood to the heart or by producing a more even distribution through existing coronary circulation The procedures used may be classified as follows (1) the introduction of an irritating substance (talc or powdered asbestos) into the pericardial sac (2) abrasion of the surface of the heart mechanically or chemically (3) transplantation of other organs or tissues to the surface of the heart (omentum spleen intestine pectoral muscle lung) (4) complete or partial ligation of the coronary sinus (5) creation of an arteriovenous shunt between a systemic artery and the coronary sinus (6) implantation of a systemic artery into the myocardium of the left ventricle (7) anastomosis of a systemic artery and a coronary artery directly or by graft (8) ligation of internal mammary arteries (9) attempts at removal of intraluminal atheromatous obstructions (coronary endarterectomy) Practically all procedures were originally applied to experimental animals usually dogs where the effects of atherosclerosis were simulated in most cases by ligation of one of the coronary arteries Results were based on survival rates exercise tolerance tests coronary arteriograms coronary injection studies retrograde coronary artery flow rates and coronary sinus flow rates Many procedures were abandoned in the laboratory because they fell short of reasonable promise but many others have been used in human beings with results that have been disappointing or controversial to say the least Some operations were abandoned rather quickly because of very high mortality Other operations have had widespread popularity because of the ease of performance and the relatively small operative risk Objective results are difficult to estimate in this condition and most writers evaluate their favorite procedure on the basis of survival figures and subjective improvement Survival figures certainly are important but as has been demonstrated so many times subjective evaluations are often unreliable and misleading Therefore one must be somewhat cautious in accepting the results of these procedures

At The New York Hospital the authors cannot speak from any first hand clinical experience either for or against any of these operations Although they do not actually oppose them the authors have not been sufficiently impressed with the clinical results of others and the data accumulated so far to embark on a clinical series involving any one or more of these procedures Yet in all fairness and for the sake of completeness further mention should be made here of the reported clinical experience of various surgeons throughout the country who are performing these operations Although ages are not always given the patients affected tend to be in the older age group

Beck has been a pioneer in the field of surgery for coronary artery disease His operation referred to as the *Beck II operation* consists in making a communication between the aorta and the *coronary sinus* by means of a vein graft and partial ligation of the coronary sinus However because of a rather high mortality rate and technical difficulties in performing the operation Beck now prefers what is known as the *Beck I*

can hypertrophy, develop a higher pressure during systole, and compensate for gradually decreasing aortic valve opening The long-term follow up studies on unoperated patients have shown that symptoms appeared first at an average age of 47 The mean survival time was only 9 years after the onset of symptoms About one half the patients developed angina, and the average survival time after this appeared was 5 years In the one fifth of the patients who had syncope death followed in an average of 3 years Thus it is quite obvious that once symptoms develop in aortic stenosis the course is rapidly downhill and death occurs most commonly in the middle or late fifties

In general, the experience with the surgical treatment of acquired aortic stenosis has not been nearly as gratifying as that with mitral stenosis The operative mortality has been higher and the results have been poorer Older patients with aortic stenosis are more apt to have coronary atherosclerosis, and this considerably increases the risk of operation On the other hand coronary atherosclerosis can be associated with a calcific but nonstenotic aortic valve and clinically closely resembles aortic stenosis In many instances it may be difficult to rule out coronary atherosclerosis in older patients and the degree of aortic stenosis should be evaluated by the left heart catheterization

At The New York Hospital calcific aortic stenosis has been treated surgically a number of ways The oldest patient to survive surgery was 57 Her valve was opened through the transventricular route by means of an expanding valvulotome a method now abandoned However some surgeons are reporting excellent results from the use of a new slender expanding valvulotome inserted through the left ventricle Hypothermia would seem to have no place in the direct approach to the aortic valve in elderly patients because of the danger of ventricular fibrillation Some surgeons still prefer to open the stenosed aortic valve digitally through a diverticulum sewed to the wall of the ascending aorta At the present time at The New York Hospital–Cornell Medical Center the most satisfactory method of dealing with the stenosed aortic valve is by direct exposure using the pump oxygenator and potassium citrate arrest The oldest patient treated by this technique was 50, and she has been greatly improved Cooley reports having successfully operated on a 65 year old man with calcific aortic stenosis with use of a pump oxygenator

Ideally, aortic stenosis should be treated before the patient reaches old age but when patients in their late fifties are seen operation may be offered provided that there is a significant gradient over the aortic valve on left heart catheterization and that there is no severe coronary artery disease minimal aortic regurgitation and no intractable left heart failure

Regurgitation through the aortic valve may be the result of rheumatic fever, syphilis or trauma or it may be present as a feature of Marfan s syndrome Aortic insufficiency may be present for many years with little in the way of symptoms but once symptoms have begun the disease may run a rapid course This is especially true of aortic insufficiency due to syphilis where the progress of the disease is almost twice as rapid as in that due to rheumatic fever

The plastic ball valve of Hufnagel has been the most widely employed means of partially correcting the regurgitation through the aortic valve It is estimated that this reduces the load on the left ventricle by 75 per cent Even so, there are not many reports of its successful use in patients over the age of 50 Efforts toward correction of aortic insufficiency by placing circumcluding sutures about the base of the aorta have not been encouraging Various methods of overcoming aortic regurgitation by placing plastic valves in the aorta below the coronary ostia and by placing ball valves in prostheses between the apex of the heart and the descending aorta are in the experimental stages they must be worked out in the laboratory and

tried in young patients before they can be applied to older ones

CORONARY ARTERY DISEASE

In our population coronary artery disease is one of the greatest problems medical science faces today It is seen with twice the frequency of rheumatic heart disease and is thirty times as frequent as congenital forms of heart disease As the proportion and actual number of elder citizens increases so will there be an even greater increase in the number of patients afflicted with this condition

The problem of coronary arteriosclerosis and its treatment by operative means has offered a tantalizing challenge to the surgical investigator and the course of investigation has followed a number of different patterns Since the basic difficulty in coronary artery disease is a decrease in blood supply virtually all methods strive to overcome this by bringing more blood to the heart or by producing a more even distribution through existing coronary circulation The procedures used may be classified as follows (1) the introduction of an irritating substance (talc or powdered asbestos) into the pericardial sac (2) abrasion of the surface of the heart mechanically or chemically (3) transplantation of other organs or tissues to the surface of the heart (omentum spleen intestine pectoral muscle lung) (4) complete or partial ligation of the coronary sinus (5) creation of an arteriovenous shunt between a systemic artery and the coronary sinus (6) implantation of a systemic artery into the myocardium of the left ventricle (7) anastomosis of a systemic artery and a coronary artery directly or by graft (8) ligation of internal mammary arteries (9) attempts at removal of intraluminal atheromatous obstructions (coronary endarterectomy) Practically all procedures were originally applied to experimental animals usually dogs where the effects of atherosclerosis were simulated in most cases by ligation of one of the coronary arteries Results were based on survival rates exercise tolerance tests coronary arteriograms coronary injection studies retrograde coronary artery flow rates and coronary sinus flow rates Many procedures were abandoned in the laboratory because they fell short of reasonable promise but many others have been used in human beings with results that have been disappointing or controversial to say the least Some operations were abandoned rather quickly because of very high mortality Other operations have had widespread popularity because of the ease of performance and the relatively small operative risk Objective results are difficult to estimate in this condition and most writers evaluate their favorite procedure on the basis of survival figures and subjective improvement Survival figures certainly are important but as has been demonstrated so many times subjective evaluations are often unreliable and misleading Therefore one must be somewhat cautious in accepting the results of these procedures

At The New York Hospital the authors cannot speak from any first hand clinical experience either for or against any of these operations Although they do not actually oppose them the authors have not been sufficiently impressed with the clinical results of others and the data accumulated so far to embark on a clinical series involving any one or more of these procedures Yet in all fairness and for the sake of completeness further mention should be made here of the reported clinical experience of various surgeons throughout the country who are performing these operations Although ages are not always given the patients affected tend to be in the older age group

Beck has been a pioneer in the field of surgery for coronary artery disease His operation referred to as the *Beck II operation* consists in making a communication between the aorta and the coronary sinus by means of a vein graft and partial ligation of the coronary sinus However because of a rather high mortality rate and technical difficulties in performing the operation Beck now prefers what is known as the *Beck I*

operation The Beck I operation was originated in 1935 but has been modified a number of times The procedure now includes the following features abrasion of the inner surface of the pericardium and the epicardium narrowing of the coronary sinus to a diameter of 3 mm, application of 0 3 Gm of powdered asbestos to the surface of the heart as an inflammatory agent and application of the parietal pericardium and its fat to the surface of the heart as a graft Beck advocates the operation for patients with coronary insufficiency who have angina pectoris without evidence of an infarct For patients who have had one or more infarcts, 6 months should be allowed between the last infarct and surgery Beck had experience with over 300 patients operated on for coronary artery disease and was able to report no operative deaths in a series of 100 consecutive operations Clinical improvement and increased longevity were reported in 9 out of 10 patients Patients as old as 72 years have been operated upon by Beck, and in a series of 185 patients 20 were over the age of 60

For over 15 years Thompson has been performing an operation for myocardial ischemia which he calls *cardiopexy* or *pericardiopexy* The operation is very simply and easily carried out without even entering the pleural cavity The pericardium is entered through the bed of the resected left fifth costal cartilage, and 2 to 4 dr of sterile magnesium silicate powder (U S P Talc) are spread evenly over the surface of the heart This irritating substance is said to produce a marked hyperemia of the myocardium with dilatation of preexisting blood vessels and the formation of new blood vessels within the myocardium Later a foreign body granuloma is produced which involves the pericardium and the superficial surface of the myocardium This adhesive granulomatous pericarditis is thought not to produce constrictions and is regarded as forming extracardiac and intracardiac anastomoses The material from 10 autopsies performed at varying intervals 1 to 10 years after operation did not indicate that this granulomatous tissue eventually changed to avascular scar tissue Reviewing a 14 year experience with this operation Thompson reported an operative and hospital mortality rate of 12 per cent in 57 patients The oldest patient was 68, and the majority of these patients were in the sixth decade Ninety per cent of the survivors were improved more than 50 per cent and their life span was prolonged significantly

Vineberg has demonstrated that a systemic artery the internal mammary may be transplanted into an artificially created tunnel in the myocardium of the left ventricle and that the transplanted artery will send out branches which communicate with the small branches and arterioles of the coronary arteries In a series of 88 patients with coronary artery disease who had been operated upon by this technique, Vineberg and Walker reported an operative mortality of 14 7 per cent However, in the 68 patients who had no angina at rest, the operative mortality was only 5 89 per cent In the first 29 patients operated upon by Vineberg the oldest patient was 60, and 18 patients were over the age of 50 most of these in the latter portion of the sixth decade Vineberg considered the indications for surgery to be proved coronary artery disease with typical angina pectoris and failure to improve within 1 or 2 years with medical treatment Left ventricular failure and recent myocardial infarctions are contraindications In the series of 88 patients Vineberg stated that 72 per cent were disabled before surgery and 79 per cent returned to work after surgery, 73 per cent of the survivors were free of pain or had slight or less pain

During the last 2 years there has been a wave of enthusiasm for an operation that originated in Italy bilateral internal mammary ligation The most appealing feature of this procedure has been its ease and simplicity of performance It can be done under local anesthesia with minimal risk to the patient Three Italians Battezatti Tagliaferra and de Marchi in 1955 reported the results of this operation on 11 patients suf

fering from angina pectoris all of whom were said to be free of anginal pain after operation and considerably improved with regard to dyspnea The rationale of the procedure is that the pericardiophrenic branch of the internal mammary artery has ramifications which communicate with the coronary artery and that bilateral ligation of the internal mammary artery in the second intercostal space distal to the pericardiophrenic branch will increase the blood flow through the pericardiophrenic branch and thereby improve the coronary circulation Experimental proof of this thesis has been difficult to obtain as has objective clinical evaluation Glover has reported his experience with 77 patients who had coronary insufficiency and angina pectoris The oldest patient was 82 years of age Sixteen were over 60 years of these 5 were over 70 and 2 were over 80 Two deaths occurred in the hospital after operation and 3 other patients aged 65 72 and 82, died within 35 days after the operation Among 50 patients who were followed for 1 to 5 months after surgery, 36 per cent were free of pains and 32 per cent were improved The remaining 32 per cent were unimproved Preliminary reports from several controlled series of such procedures done at various centers suggest that equal results may be obtained with a sham operation where the internal mammary arteries were not ligated

A direct attack upon the diseased coronary artery is the most recent approach to the problem of coronary arteriosclerosis to be attempted clinically and is still very much in the experimental stage of development It has been noted that 69 per cent of the occlusions in the main stems of the coronary arteries are localized in the proximal 4 cm of these vessels In some of these patients it has been noted also that the distal ramifications of the coronary arteries are free of disease Lillehei demonstrated in 1956 on cadavers with coronary artery disease that the removal of lesions of the proximal coronary arteries was possible by performing coronary endarterectomy Subsequently Bailey has reported coronary endarterectomy performed on six patients four of whom were 50 52 56 and 56 years of age respectively All of these were said to have been improved Recently Longmire reported upon seven patients who underwent coronary endarterectomy These early operations on the coronary arteries have been done on the beating heart and without the support of a pump oxygenator One of the difficulties at the present time is in the selection of patients for this procedure Longmire has taken patients who had not had a coronary occlusion but who developed pain and electrocardiographic changes on exercise Selective coronary angiocardiography, when it can be made sufficiently safe, will undoubtedly be of tremendous aid in choosing the patients who are the ideal candidates for coronary endarterectomy As pump oxygenators are improved one may be certain that they will play an important role in this type of surgery not only at the time of the operation but in the support of the patient before and after surgery by partial or complete perfusions as necessary

BIBLIOGRAPHY

Absolon K B Aust J B Varco R L and Lillehei C W Surgical Treatment of Occlusive Coronary Artery Disease by Endarterectomy or Anastomotic Replacement Surg Gynec & Obst 103 180 1956

Bahnson H T Spencer F C and Andrus E C Diagnosis and Treatment of Intracavitary Myxomas of the Heart Ann Surg 145 915 1957

Beck C S Weckesser E C and Barry F M Fatal Heart Attack and Successful Defibrillation J A M A 161 434 1956

Beck Claude S Coronary Artery Disease Physiologic Concepts—Surgical Operation Ann Surg 145 439 1957

Black Harrison and Harken Dwight E Mitral Valvuloplasty in Patients past Fifty New England J Med 259 361 1958

Bofman Bernard L Medical Evaluation of the Beck Operation for Coronary Artery Disease J A M A 162 1603 1956

Briggs B D Sheldon D B and Beecher

H K Cardiac Arrest *Study of a Thirty year Period of Operating Room Deaths at Massachusetts General Hospital 1925-1954* J A M A 160 1439 1956

Brown E B Jr and Miller F Ventricular Fibrillation Following a Rapid Fall in Alveolar Carbon Dioxide Concentration Am J Physiol 169 56 1952

Buckner F Lyons C and Perkins R Management of Lacerations of the *Great Vessels* of the Upper Thorax and Base of the Neck *Surg Gynec & Obst 107 135 1958*

Clagett O T Kirklin J W and Edwards J E Anatomic Variations and Pathologic Changes in Coarctation of the Aorta Surg Gynec & Obst 98 103 1954

Coates E O Jr and Drake E H Myxoma of the Right Atrium with Variable Right to Left Shunt New England J Med 259 165 1958

Cooley Denton A Discussion *of paper by* Spencer Frank C Neill Catherine A and *Bahnson Henry T The Treatment of Con*genital Aortic Stenosis with Valvotomy during Cardiac Pulmonary By pass *Surgery 44* 123 1958

Cooley Jack C Claggett O Theron and Kirklin John W Surgical Aspects of Chronic Constrictive Pericarditis Ann Surg 147 488 1958

Ellis F H, Jr Mankin H T and Burchell H B Myxoma of the Atrium Successful Surgical Treatment in Two Cases M Clin North America July 1087 *1958*

Gadboys H L and Glover R P Practical *Management of Aortic Stenosis J A M A* 168 229 1958

Gerbode F Osborn J J Robson G B Braimbridge M and Hultgren H Left *Atrial Myxoma Successful Removal with* the Aid of Extracorporeal Circulation Ann Surg 147 320 1958

Geriatric Medicine Medical Care of Later Maturity Edward J Stieglitz (ed) *J B* Lippincott Company New York 1954

Glover R P Davila J C Kyle R H Trout R G and Kitchell J R Ligation of the Internal Mammary Arteries as a Means of Increasing Blood Supply to the Myocardium J Thoracic Surg 34 661 1957

Gross Robert E *The Surgery of Infancy and Childhood* W B Saunders Company Philadelphia 1953

Harken Dwight E The Surgical Treatment of Acquired Valvular Disease Circulation 18 *1 1958*

Hellerstein H K Evaluation of Surgical Methods in the Treatment of Coronary Artery Disease Mod Concepts Cardiovas Dis 26 411 1957

Heuer George J and *Stewart Harold J The* Surgical Treatment of Chronic Constrictive *Pericarditis S Clin North America 26 477* 1946

Holman Emil and Willett F Results of Radical Pericardiectomy of Constrictive Pericarditis *J A M A 157 789 1955*

Hufnagel C A Harvey, W P Rabil P J and McDermott T F Surgical Correction of Aortic Insufficiency Surgery 35 673 1954

Kaufman B H and Cohen, S E Primary Tumor of the Heart (Recticulum Cell Sarcoma) *New York J* Med 57 2652 1957

Lefcoe N M Brien F S and Manning *G W An Opening Snap Recorded in a* Case of Tumor of the Left Atrium New *England J Med 257 178 1957*

Lekisch K Myxoma of the Left Atrium Report of a Case Ann Int *Med 46 983* 1957

Lewis J F Winchell P, and Bashour F A Open Repair of Atrial Septal Defects J A M A 165 922 1957

Lillehei C W Gott V L DeWall R A and Varco R L The Surgical Treatment of Stenotic or Regurgitant Lesions of the Mitral and Aortic Valves by Direct Vision Utilizing a Pump oxygenator J Thoracic Surg 35 154 1958

May A M and Bailey C P Coronary Endarterectomy J Internat Coll Surgeons *29 160 1958*

Maynard A D Avecilla M J and Naclerio E A The *Management of* Wounds of the Heart A Recent Series of 43 Cases with Comment on *Pericardiocentesis in* Hemopericardium Ann Surg 144 1018 1956

Olesen K H and *Warburg E* Isolated Aortic Stenosis The Late Prognosis Acta med scandinav *160 437 1958*

Peery Thomas M Brucellosis and Heart Disease J A M A *166 1123 1958*

Safar P Mouth to Mouth Airway Anesthesiology 18 904 1957

Scannell J G and Grillo H C Primary

Tumors of the Heart J Thoracic Surg 35 23 1958
Schilder D P Harvey W P and Hufnagel C A Rheumatoid Spondylitis and Aortic Insufficiency New England J Med 255 11 1956
Segal J Harvey W P and Hufnagel C Course of Rheumatic Aortic Insufficiency Am J Med 21 200 1956
Surgical Treatment of Coarctation of the Aorta Dis Chest 31 468 1957
Thompson S A and Plachta A Fourteen Years Experience with Cardiopexy in the Treatment of Coronary Artery Disease J Thoracic Surg 27 64 1954
Uricchio Joseph F The Surgical Treatment of Mitral and Aortic Stenosis in Patients over 55 Geriatrics 13 270 1958
Vineberg A and Walker J Six Months to Six Years Experience with Coronary Artery Insufficiency Treated by Internal Mammary Artery Implantation Am Heart J 54 851 1957
Wilkinson A H Jr Buttram T L Reid W A and Howard J M Cardiac Injuries An Evaluation of the Immediate and Long Range Results of Treatment Ann Surg 147 347 1958
Williams G Rainey Jr and Spencer Frank C The Clinical Use of Hypothermia Following Cardiac Arrest Ann Surg 148 462 1958
Zoll P M Linenthal A J Norman L R and Paul M H Use of External Electric Pacemaker in Cardiac Arrest J A M A 159 1428 1955

12

Abdominal Aortic Aneurysm

S W Moore

Abdominal aortic aneurysms occur in the older age group Of the author s 43 patients upon which this discussion is based, 30, or 70 per cent were over 60 years of age, of the 38 resected 26 or 68 per cent were over 60 years of age

Surgery for this condition was first used in 1817, almost 150 years ago, when Sir Ashley Cooper first ligated the abdominal aorta for an aneurysm in the left groin Without anesthesia and before the time of Lister he made a 3 in incision just to the left of the umbilicus passed his finger into the abdomen by means of a fingernail scratched through the peritoneum to the left of the aorta passed his finger beneath this structure and then ligated the aorta The patient survived the operation 40 hours It was only 10 years ago in 1948, that Gross first used homologous grafts to bridge defects in the aorta after excision of long coarcted segments

Hippocrates apparently was not familiar with aneurysms Although Galen did mention those resulting from injury it is questionable whether he understood the spontaneous ones or not Alexis Carrel, in 1907 predicted that aneurysms could be removed and the excised segment replaced by graft from another human being Despite this the grand old master of aneurysms Rudolph Matas 2 years later in 1909, stated that it was unlikely that aneurysm of the aorta would ever be operated upon successfully

The real impetus to vascular surgery was sparked by Gross in Boston who in 1939 successfully ligated the patent ductus arteriosus Again in 1945, Gross and Crafoord independently reported successful resection of the aorta for coarctation By this time antibiotics blood banks, and better anesthesia had become available Swann in 1949 excised the coarcted segment of an aorta together with an associated aneurysm and repaired the defect by a homologous graft Apparently this was the first aneurysm of the aorta to be removed and replaced by a graft Dubost in 1951, was the first to attack deliberately a large abdominal aneurysm remove it and restore the vessel by a homologous graft The remainder of the story is well known

HISTOLOGY

Despite the large literature about abdominal aneurysms there is very little concerning the precise nature of their histology pathology or exact development

A large part of the human body is composed of tissues which are designed in such a way as to enable them to perform mechanical functions Some of these tissues may be considered as essentially in an intercellular position The connective tissue in the body always contains fibers in its intercellular substance They are usually present in the form of fibrils membranes or matrices This intercellular substance forms the main mass of the tissue and includes the elastic or yellow fibers and the collagenous or white fibers

Elastic fibers are long and run in various

directions They appear as brilliant highly refractive cylindrical threads or flat ribbons much thinner than the collagenous fibers The elastic fibers are usually homogeneous rather than fibrillar as the collagenous fibers and in large numbers have a yellowish color on microscopic examination

Elastic fiber yields easily on stretching The breaking point occurs when they are stretched to about 150 per cent of their original length Their strength is only a fraction of the strength of collagen When released after stretching elastic fibers return practically entirely to their former length

Collagenous fibers are long straight or wavy threads or ribbons They run in all directions and their ends cannot be found They are colorless and show longitudinal striation which in cross section makes them seem granular This microscopic appearance results from the fact that the fibers consist of parallel fibrils held together by a cementing substance On the surface of the fiber the cement substance forms a thin membrane The fibrils are thought not to branch but the fibers branch in many places

The collagenous fibers are flexible but offer a great resistance to a pulling force The breaking point of human collagenous fibers is reached after a strong pull and at this point their elongation is only a few per cent

Elastic tissue is always in association with collagenous tissue The proportions of each vary within wide ranges Above all the intimate association of elastic tissue with smooth muscle is notable This is so constant that some consider the combination as one tissue a myoelastic tissue Here the anastomosing networks pass between and embrace smooth muscle fibers

In the aorta the intima is rather thick and contains collagenous fibers as well as elastic fibers which pass into a fenestrated elastic tissue in the form of concentric fenestrated elastic membranes In the spaces between two adjacent elastic membranes are thin layers of connective tissue with thin collagenous and elastic fibers fibroblasts and smooth muscle cells The adventitia is relatively thin and cannot be sharply distinguished from the surrounding connective tissue

It seems that the elastic fiber first appears as a continuous fibril In the human embryo it makes its appearance during the third or fourth week, at which time it is found in the aorta There has been much difference of opinion concerning the exact origin of elastic tissue but in general the development of elastica in the wall of blood vessels is more or less proportional to the pressure of blood within the vessel

The walls of the aorta being composed of an elastic easily expanding tissue only a part of the force of contraction of the heart immediately advances the blood The remainder of the force expands this large elastic artery and is accumulated as potential energy in the increased elastic tension of the arterial wall With closure of the aortic valve this tension becomes transformed into kinetic energy which moves the blood forward while the heart is filling with more blood

The aorta reaches its mature form only in adult life Although the three main layers are acquired in embryonic life the intima becomes complete only at about thirty years of age As the vessel grows older it is hard to separate the physiologic from the pathologic It is clear that usually the aorta shows much greater change with age than do the arteries of muscular type Arteriosclerosis in its common form begins in childhood and progresses throughout life more rapidly in some than in others

As the aorta grows old or wears out there is an irregular thickening of the intima Later as fat infiltrates the interstitial substance the degenerative processes begin In the media the elastin of the fenestrated membrane may transform into nonelastic elacin The most important intimal change is essentially proliferative If left undisturbed by degenerative changes this results in tissue which resembles the subjacent vascular wall Therefore this reaction may be regarded as

a reparative process Hemorrhages from the newly developed capillary network are common

Looking for a clear understanding of the development of abdominal aneurysms, Hass stated

> The first thing to happen is a deterioration of the elastic tissue resulting in transverse fractures of the elastic lamellae and a progressive over distention of the remaining networks With the progress of over distention and continuous deterioration of elastic tissue there is a reactive formation of collagen in the aortic wall and a depletion of the number of smooth muscle cells The newly formed collagenous framework would seem to be unsuitable for resistance against the pressure and as experience generally shows gradual distention from an aneurysm Inasmuch as these processes ordinarily develop in older people there is usually a superposition of intimal atherosclerotic changes which weaken the vessel wall Calcium salts are also usually deposited in various parts of the degenerated wall With diminution of elasticity and a decrease in the number of smooth muscle cells the deteriorative changes of atherosclerosis and calcific disease so affect the remaining collagenous framework that rupture ordinarily occurs I doubt whether rupture of an aneurysm ever occurs in the presence of intact elastic networks or even in the presence of normal smooth muscle structure

PROGNOSIS AND ETIOLOGY

Many series of patients with aortic aneurysms have been reported Some of these are autopsy reports, and others are selected groups Pertinent material regarding prognosis of abdominal aortic aneurysm is scarce Estes has reported on the life expectancy of 102 patients seen at the Mayo Clinic While 67 per cent survived 1 year and 58 per cent survived 2 years only 19 per cent survived 5 years and 10 per cent 8 years In a series of 68 patients from The New York Hospital–Cornell Medical Center Wright found that 40 per cent lived 1 year 30 per cent 2 years and 4 per cent 5 years Gliedman Ayers, and Vestal were even more pessimistic in their report from Kings County Hospital in Brooklyn N Y They reported 68 patients with 96 abdomi

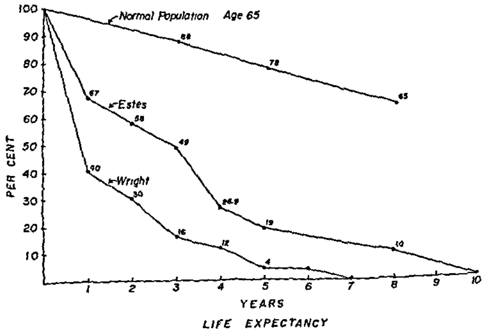


Fig 12 1 The top line shows the life expectancy of the normal population at age 65 Next is the life expectancy in 102 patients with abdominal aortic aneurysms as shown by Estes from the Mayo Clinic The bottom curve is from a report by Wright at The New York Hospital concerning 68 patients with abdominal aortic aneurysms

nal aneurysms, 72 of which were aortic In this group 80 per cent were dead within 1 year of the onset of symptoms, and 49 per cent died from a vascular rupture (Fig 12 1)

Aneurysms in the chest have long been considered almost entirely syphilitic In a series of 365 cases of aortic aneurysms, Blakemore found that 182 of 192 syphilitic aneurysms occurred in the thoracic aorta and only 10 in the abdominal aorta On the other hand those in the abdominal portion of this vessel are largely arteriosclerotic With the diminishing incidence of syphilis and the increase in the longevity of the general population arteriosclerosis is becoming even more significant as the cause of aneurysms particularly of those in the abdominal aorta These occur in the older age group and almost entirely from age 50 to 80 (Fig 12 2) The author finds that 70 per cent of abdominal aneurysms occur in persons over the age of 60 Males outnumber females almost 5 1 in this series This is true in all reports and there is no clear explanation for this fact

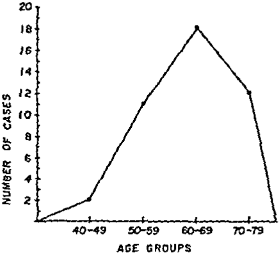


Fig 12 2 In 43 patients with abdominal aortic aneurysms only 2 were under 50 years of age and 1 of these was 49 Thirty or 70 per cent were over 60 years of age None was over 80 years of age

Arteriosclerosis causes arteries to elongate and become tortuous as can readily be observed in the aged The abdominal aorta is fixed both as it passes through the diaphragm and at its bifurcation Because of this fixation at two points as the aorta elongates in the formation of an aneurysm it must deviate from the midline This deviation is usually to the left sometimes to the right in some cases it seems to come up from the spine In the last group they are much easier to palpate and can frequently be seen to pulsate Characteristically these aneurysms start 1 or 2 cm below the renal arteries are fusiform in shape involve the bifurcation and extend into one or both of the common iliac arteries

SYMPTOMS

As in so many other conditions aneurysms in the early stage are usually without symptoms and symptoms when they develop may signify the onset of a complication such as leaking rupture erosion of the vertebrae or pressure on other organs The aneurysm usually starts as a nontender movable mass but with the onset of perforation it becomes fixed and tender In reported series and in this group also pain is the major complaint although many patients have no pain This pain may be in the abdomen in the back or in the legs Pain is usually more prominent in those patients who are seen surgically As the aneurysm is directly beneath the duodenum anorexia and vomiting are common symptoms

SIGNS

The usual physical finding is an expansile pulsating mass in the upper abdomen This is usually on the left but it may be on the right and in many cases extends into the pelvis These aneurysms are frequently multiple With one in the abdominal aorta there may be one two or three in the iliac vessels In order to demonstrate expansile pulsation it is well to use two fingers and preferably both hands When the mass is seen to ex

pand laterally, and with experience on the part of the observer, there is usually very little question as regards diagnosis A large number of cases in this series was diagnosed by physical examination It is interesting that four were found at operation for other abdominal conditions three of these at operation for peptic ulcer one of which had perforated Except in the case of very small aneurysms, diagnosis presents no major problem to the experienced examiner

ROENTGEN RAY EXAMINATION

With increased experience and awareness the diagnosis is made much more often by roentgen ray examination from a characteristic shadow in the left side outlined with a rim of calcium A lateral film should always be made as this will get the spine out of the way and may even show erosion of the vertebrae missed on the anterior posterior view

AORTOGRAMS

In the past aortograms were used routinely to establish the diagnosis While this is helpful in many ways, experience has shown that in most cases it is not necessary Furthermore, there are disconcerting reports of harmful effects from the procedure particularly renal injury and spinal cord damage Although intramural injection of the contrast media or paraaortic extravasation causes little difficulty injection of the material into the aortic visceral branches such as the renal superior mesentery or celiac axis may result in death

Spinal cord damage is feared most The lumbar arteries are inconstant in size and location The arteries to the spinal cord are also inconstant When a major artery contributing blood to the spinal cord receives a large dose of contrast media there may be difficulty It has been shown recently in animals that Hypaque is much less damaging to the spinal cord than Urokon Although one would expect hemorrhage from piercing of the aorta with a large needle there seems to be very little difficulty in this regard

COURSE

Rupture of the aneurysm occurs in 50 per cent of patients with abdominal aortic aneurysm Without operation it is always fatal There is frequently a warning. This is short Death is sudden Many have been saved by emergency operation, and this should be attempted With the above in mind there are few contraindications to operation as soon as the diagnosis is made Age is not a contraindication as almost all these patients are in the older age group The majority have hypertension, and this is not a contraindication The mortality in the hypertensive group has been less than in those with the lower pressure in the author s experience In the latter group the arteriosclerosis may be more extensive Since death following operation is usually caused by renal or cardiac complications these systems should be carefully evaluated before operation There are very few nonfatal complications following operation

TREATMENT

Treatment in the past has been largely unsuccessful Starting with ligation of the aorta, as mentioned by Sir Ashley Cooper attempts have been made to induce thrombosis within the aneurysm by inserting wire reinforcing the wall to prevent further enlargement or perforation These procedures have proved to be inadequate and have provided only temporary relief or have resulted in disaster Because of increasing dissatisfaction with these methods surgeons have become bolder and attacked the lesion directly They have resected the aneurysm and restored continuity of the vessel by means of homografts or synthetic prostheses of various types Most surgeons use almost an identical procedure in operating for aneurysm and the essential steps are fairly well standardized

OPERATION

The abdomen is opened through a long incision Usually the author retracts the left rectus muscle After mobilizing the ligament of Treitz the small intestine is placed on the abdominal wall to the right giving excellent exposure The peritoneum is divided in the midline over the aorta and the division carried down between the iliac arteries The incision is carefully extended upwards and the left renal vein visualized Dissection is continued to expose the aorta above to give sufficient room above the aneurysm for an anastomosis The author usually likes to see or feel the renal arteries A tape is placed about the aorta above the aneurysm and below the renal artery Going below the iliac vessels are evaluated for aneurysm calcification or thrombosis and then isolated One must be careful not to injure the veins which are often fused to the arteries Bleeding from veins is more troublesome than that from the arteries

A Satinsky clamp is placed about the aorta above the aneurysm below the renal arteries and clamped The iliac arteries are divided between clamps as close to the an eurysm as feasible Dissection is started from below lifting up the aneurysm and working beneath At times the veins in particular those at the junction of the common iliac veins and lower inferior vena cava are intimately fused with the aneurysm in which case the adventitia of the artery is left on the vein As the lumbar arteries are visualized they are divided between clamps and both ends ligated In certain cases this cannot be done safely because of danger to the inferior vena cava In such a situation the aneurysm is opened completely and removed piece meal leaving a section attached to the vena cava All atheromatous material must be removed leaving only the outer arterial wall All muscle layers of the artery can be re moved by blunt dissection

At times retrograde bleeding from lumbar arteries is troublesome when it is necessary to open the aneurysm A small curved clamp inserted into the mouth of these lumbar arteries stops bleeding and makes it very easy to find the vessels posteriorly where they can be ligated

After bleeding vessels are controlled and the field is cleared of all clamps the upper aorta is prepared for suture and any calcium plaques are removed The distal vessels are also prepared It may be necessary at times to ligate an internal iliac artery because of aneurysm or occlusion In other cases an end to side anastomosis to the external iliac artery or common femoral artery of the graft will allow blood to flow into the internal iliac artery Certain patients require that both in ternal and external iliac vessels be anasto mosed The author does not like to anas tomose both internal and external iliac ar teries on the same side nor does he wish to ligate an internal iliac but each patient is different and these decisions must be made

As preparations are being carried out for the prosthesis the distal vessels are opened to test for back bleeding and heparin solu tion is injected into these arteries to prevent clotting Unless there is good back bleeding the prognosis should be guarded In case of question on the table injection of a radiopaque solution into the distal artery should be done Unless the distal vascular bed is adequate resection and anastomosis can only lead to disaster in the form of thrombosis and gangrene

In dividing the proximal aorta a short cuff of vessel is left to permit satisfactory suture to the graft With No 0000 arterial silk two sutures are started posteriorly Going over and over through all layers they are con tinued anteriorly and tied The proximal anastomosis is tested by holding the graft between the fingers and releasing the Satin sky clamp If necessary an additional suture is used to stop a leak Going below usually the right anastomosis is done to the common iliac or external iliac arteries With No 00000 silk it is sutured exactly as the prox imal anastomosis The left arm of the graft is clamped and the distal clamp removed

There is backfilling into the graft Usually there is very little leakage, and it can be stopped with pressure or an additional suture Before releasing the proximal clamp on the aorta a transfusion is started to prevent a drop in the blood pressure Until this time blood is usually not necessary

Blood is allowed to run through the right anastomosis with the left common iliac of the graft clamped The left anastomosis is carried out in an identical manner Leakage from suture holes or from the prostheses is usually readily controlled by pressure from gauze sponges After observation to make certain there is no bleeding the peritoneum is closed posteriorly and the abdominal wall closed in layers

Since the arteriosclerosis is generalized and there is frequently diminished circulation in the legs with narrowing of the femoral vessels, a bilateral lumbar sympathectomy is routinely performed No anticoagulants are used after operation

To remove the aneurysm it is necessary to ligate the inferior mesenteric artery This may be thrombosed as a result of the aneurysm The inferior mesenteric artery should always be visualized at its origin and ligated close to the aorta to preserve the left colic artery whose ascending branch anastomoses with the midcolic and forms the marginal artery of Drumond After ligation of the inferior mesenteric artery the entire blood supply to the lower large intestine comes from the internal iliac arteries and the mid colic artery For this reason the author is loath to ligate the internal iliac artery on either side more so to ligate both Dual ligation was performed in one patient and there was some necrosis of the mucosa of the sigmoid McKain and Schumaker have reported two cases of stricture and necrosis of the colon in patients following resection of aneurysms, and others have reported instances of postoperative diarrhea

When the internal iliac artery is occluded the greater part of the blood supply to the hip and gluteal muscles is stopped This is more severe when there is obstruction in the femoral vessels Pain in the hip at times intermittent in type, is a sign of occlusion of these vessels As a result, following operation many patients who do have ligation of one or more internal iliac arteries complain of severe pain in that hip and upper thigh This pain is particularly severe at night but disappears with time

RESULTS

Results of this aggressive attack upon abdominal aneurysm have become increasingly gratifying throughout the country The operative mortality has steadily decreased As one would expect, it is in the group with advanced arteriosclerosis of the legs heart and kidneys in which we see postoperative difficulties Operation after rupture of the aneurysm is usually fraught with much more difficulty at the time of operation and a much higher mortality rate Despite the risk of operation after rupture without it the prognosis is hopeless, resection should always be attempted regardless of the apparent seriousness of the situation Early in the author's experience aortic homografts were used almost entirely However the author, with others in the country, has turned more and more to various types of prostheses The author has used 21 homografts and 15 prostheses in this series The latter were of the Edward Tapp crimped nylon type In one patient the aneurysm was cross clamped and excised and the aorta repaired This was the only saccular aneurysm in this series The other patient in whom a graft was not used died of hemorrhage before bleeding could be controlled

ARTERIOSCLEROSIS AND ASSOCIATED CONDITIONS

As one would expect in the age group in which abdominal aneurysms occur there is frequently an association with other conditions Cardiovascular disease and cancer are

sted as the Number 1 and 2 fatal condi ons and it is to be expected that they may e found associated with aneurysms The uthor is currently following six patients who have both carcinoma and abdominal neurysms One patient in whom an intra enous pyelogram was reported as normal ad an obvious abdominal aneurysm on hysical examination At operation the an urysm was present but in addition there was a large carcinoma of the kidney which was removed The aneurysm was not re ected In another patient with carcinoma of the large bowel demonstrated by x ray xamination and an obvious abdominal an- eurysm on physical examination the carci- noma of the large bowel was resected and he aneurysm left intact In two other pa ients in the course of an intraabdominal operation for cancer an abdominal aneurysm was found The cancer was treated and the aneurysm left intact The author has elected to give cancer priority in treatment of these patients and to follow the aneurysm

PEPTIC ULCER

In eight patients a peptic ulcer was pres ent (Table 12 1) Three of these were op erated on for the ulcer two for perforation and one for a massive hemorrhage following resection of the aneurysm In these patients the author gives preference to treatment of the abdominal aneurysm unless the ulcer is

TABLE 12 1 ASSOCIATION OF PEPTIC ULCER AND DIVERTICULITIS OF THE COLON WITH ABDOMINAL AORTIC ANEURYSMS *

	No	Per cent
Peptic ulcer	8	18 6
Perforation (1)		
Postresection (1)		
Massive hemorrhage (1)		
Diverticulitis	6	14 0

* Forty three patients with abdominal aneurysms

perforated, bleeding or obstructed feeling that the aneurysm is a greater threat to life

DIVERTICULOSIS

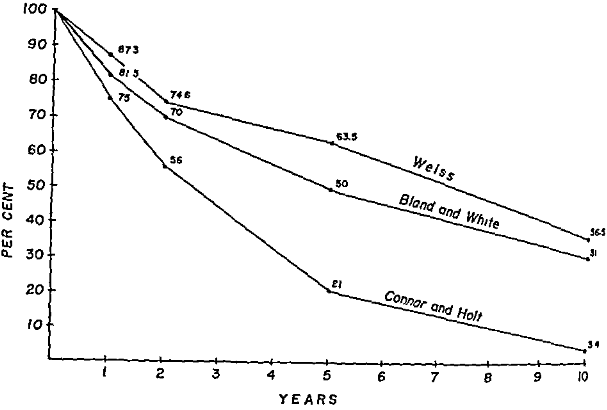
There were six patients (Table 12 1) who had diverticulosis of the colon demonstrated by x ray examination and the author is cer tain that had more of these patients had large bowel x ray films taken this instance would have been much higher Although the diverticulosis has caused little trouble at operation it does cause symptoms following operation

HEART DISEASE

Arteriosclerosis is a degenerative disease It makes itself manifest in many ways one of which is an aneurysm of the abdominal aorta This aneurysm is frequently associ ated with coronary artery disease or bundle branch block in the heart or a vascular oc clusion in the brain Reviewing this series with regard to electrocardiographic evi dence of old coronary occlusion or bundle branch block the author finds that 23 pa tients are reported as having had an abnor- mal electrocardiogram showing either an old coronary occlusion a bundle branch block or both It is in this group that all four postoperative deaths occurred (Table 12 2)

TABLE 12 2 THE ASSOCIATION OF A NORMAL ELECTROCARDIOGRAM AND A NORMAL BLOOD PRESSURE TO ABDOMINAL ANEURYSMS AND THEIR VALUE REGARDING PROGNOSIS

	No of cases	No of deaths	Mortality %
ECG normal	20	0	0
ECG coronary occlusion or bundle branch block	23	4	17 4
Blood pressure under 150 90	20	2	10 0
Blood pressure over 150 90 (1 in shock died)	22	1	4 5



PROGNOSIS AFTER MYOCARDIAL INFARCTION

Fig 12 3 The life expectancy following recovery from myocardial infarction as shown by Connor and Holt Bland and White and Weiss

In other words, the entire mortality was in those patients who had an electrocardiogram showing coronary artery disease or bundle branch block

An effort was made to find factual data concerning prognosis following myocardial infarction (Fig 12 3) Not counting mortality of the acute attack and recovery following such an episode, the patient has a 20 to 65 per cent chance of living 5 years and a 5 to 40 per cent chance of living 10 or more years

Although arteriosclerotic heart disease and hypertensive disease are not identical, it is found in this series that 22 patients had blood pressure over 150/90 whereas 20 had blood pressure under 150/90 One patient who died following operation for a ruptured *abdominal aorta was in shock*, and no true preoperative blood pressure is recorded Of the 3 others who died following operation 1 had a blood pressure over 150/90 and 2 had a blood pressure under this It is the author s impression that an elevated blood pressure does not carry nearly the poor prognosis that an abnormal electrocardiogram does

DURATION OF SYMPTOMS

Reviewing the duration of symptoms of the patients in this study (Fig 12 4) the author finds 28 who had symptoms less than 6 months Of these 8 had no symptoms of the aneurysm It was discovered on routine physical examination or by roentgen ray examination for other conditions There were 5 with symptoms between 6 and 12 months Of the 43 patients 33 had symptoms for less than 1 year It is not clear whether the symptoms listed as over 5 years duration are accurate or not

In this group of 43 patients 36 were male and 7 female almost exactly a 5 1 ratio Of the 43 patients 13 were under the age of 60 years whereas 30 were over this age

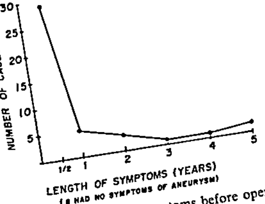


Fig 12-4 Duration of symptoms before operation in 43 patients with aortic aneurysm

(Fig 12 2) None of this group were over 80 It is also interesting that among those 13 patients under 60 were 4 who were 59 years of age

In personal experience with 43 patients there was only 1 in which no operation was recommended (Table 12 3) This patient had had one kidney removed for carcinoma and had a diffuse aneurysm which extended from the abdomen into the chest There were 4 who although explored were not resected One had carcinoma of the kidney which was removed 1 had poor peripheral vessels and it was felt that these would not carry the runoff The other 2 had large abdominal aneurysms which extended into the chest Again 1 of these had poor peripheral vessels There were 3 patients in whom rupture had occurred and attempts at resection were made, one of which was successful There were 35 patients who had resection for an abdominal aneurysm which had not ruptured previously There were two deaths while in the hospital a mortality rate of 5 7 per cent Both these patients were over 70 years of age Both had evidence of coronary artery disease or bundle branch block One had a blood pressure of over 150/90 In one patient, the clamp slipped and it was necessary to apply it at a higher level Undoubtedly the clamp was across one or both renal arteries for part of this procedure The patient died with kidney shutdown and uremia The other death was in a patient who had marked peripheral artery disease and had very little runoff He died of bilateral gangrene of the legs

Follow up of the 34 patients who survived operation and left the hospital (Table 12 4) shows the following There are 3 known dead 1 patient developed an abscess about the suture line which broke down and he died of a massive hemorrhage at 6 weeks another died of carcinoma of the cervix at 2 years another died of coronary occlusion at 3 years The remaining 31 are living and well at the last follow up which includes 3 who have been followed over 5 years Although many of these patients have retired and some have not been working for other reasons a large number have gone

TABLE 12 3 ABDOMINAL AORTIC ANEURYSM OPERATIVE EXPERIENCE *

	No	Deaths	Mortality %
No operation	1		
Exploration (no resection)	4	0	0
Ruptured (resection)	3	2	66 0
Nonruptured (resection)	35	2	5 7
Total cases resected	38	4	10 5
Total cases	43		

Total experience 43 cases male 36 female 7

TABLE 12-4 FOLLOW UP OF PATIENTS AFTER RESECTION OF ABDOMINAL AORTIC ANEURYSM

	No of Patients
Patients resected	38
Operative deaths	4
Total followed	31
Known dead	3
Living and well	31
<6 mo	6
>12 mo	11
>2 yr	2
>3 yr	7
>4 yr	2
>5 yr	3

One died of abscess and hemorrhage of suture line at 6 wk one of carcinoma of the cervix at 2 yr and one of coronary occlusion at 3 yr

back to work It has been the author s advice to patients living a strenuous life and working hard to slow down following resection for abdominal aneurysm All are encouraged to do that which makes them happiest In several cases the patient has been delighted to go to work because of associations while at work and even at times to escape situations at home

BIBLIOGRAPHY

Blakemore A H and Voorhees A R Jr Aneurysm of the Aorta A Review of 365 Cases Angiology 5 209 1954

Bland E F and White P D Coronary Thrombosis (with Myocardial Infarction) Ten Years Later J A M A 117 1171 1941

Connor L A and Holt E The Subsequent Course and Prognosis in Coronary Thrombosis Analysis of 287 Cases Am Heart J 5 705 1930

De Bakey M E Cooley D A and Creech O Jr *Treatment of Aneurysms and Occlusive Disease of the Aorta by Resection* Analysis of 87 Cases J A M A 157 203 1955

Dubost C Allary M and Oeconomos N Resection of an Aneurysm of the Abdominal Aorta A M A Arch Surg 64 405 1952

Estes J E Abdominal Aortic Aneurysm Study of 102 Cases Circulation 2 258 1950

Gliedman M L Ayers W B and Vestal B L Aneurysms of the Abdominal Aorta and Its Branches—A Study of Untreated Patients Ann Surg 146 207 1957

Hass G M Personal communication

Maximow and Bloom *A Textbook of Histology* W B Saunders Company Philadelphia 1957

McKain J C and Schumaker H B Ischemia of the Left Colon Associated with Abdominal Aortic Aneurysms and Their Treatment A M A Arch Surg 76 355 1958

Moore S W Resection of the Abdominal Aorta with Defect Replaced by Homologous Graft Surg Gynec & Obst 99 745, 1954

Weiss M M Ten Year Prognosis of Acute Myocardial Infarction Am J M Sc 231 9 1956

Wright I S Urdaneta E and Wright B Reopening the Case of the Abdominal Aortic Aneurysm Circulation 13 754 1956

Part 4

Gastrointestinal Surgery

13

Peptic Ulcer

John M Beal and George Johnson

Peptic ulcer in older patients presents particular difficulties in management because, as age increases the complications of this disease are associated with a higher mortality and morbidity rate The incidence of peptic ulceration in the general population and in the aged is difficult to determine with accuracy Although duodenal ulcer appears to have its highest incidence in the third and fourth decades of life many older patients have symptoms of brief duration and in these the disease has its apparent inception in the later decades of life Gastric ulcer in contrast increases in frequency with age and appears to have its greatest incidence in the sixth to eighth decades of life

The diagnosis of peptic ulcer in the elderly patient often taxes the acumen of the physician Many older patients tend to ignore abdominal distress and in many the ulcer pain is apparently mild in character Thus medical attention is often sought only after the occurrence of one of the complications of ulcer such as perforation or hemorrhage In others manifestations of peptic ulcer persist for many years but culminate with one of the major complications of ulcer in later years of life when the patient has developed degenerative diseases of other systems The management of these patients is therefore much more complex In addition acute ulceration is occasionally encountered in an older person who has an unrelated serious disease process For these reasons the treatment of the older patient with peptic ulceration particularly if operative intervention is required presents the physician with a complex and arduous task

Because there are certain differences in their clinical and pathologic behavior, duodenal gastric and marginal ulcers after the age of 65 years are considered separately in this chapter Duodenal ulcers occur with the greatest frequency in the authors experience and gastric ulcers are encountered more often than are marginal ulcers

DUODENAL ULCER

Duodenal ulcer occurs with greater frequency in men than in women and this sex difference continues into the older age groups Among 100 patients 65 years of age or older who were treated on the surgical service of The New York Hospital–Cornell Medical Center 81 were men and 19 were women All these patients were subjected to some type of surgical procedure in the treatment of their duodenal ulceration There has been a progressive decrease in frequency however after the age of 65 years (Fig 13 1)

Although many patients who require surgical treatment of duodenal ulcer have symptoms of long duration often the manifestations of ulcer develop after the age of 60 Of our patients 65 years of age or older 24 per cent had symptoms that were of 1 year s duration or less and 22 per cent had symptoms for less than 5 years In many instances the pain was apparently less severe than is typical of the younger patient al

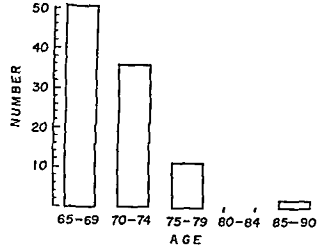


Fig 13 1 Incidence of duodenal ulcer in patients 65 years of age and older at The New York Hospital

though the relief from the ingestion of milk or antacids was usually elicited In 17 patients the ulcer distress had been present for more than 25 years before operation was undertaken for one of the complications of peptic ulcer disease

In the older patient operative intervention has usually been reserved for those who have the more severe complications of duodenal ulcer Pain unrelieved by conservative management was an indication for operation in only 10 per cent of this group Pyloric obstruction is the most frequently encountered problem that requires surgery in the treatment of duodenal ulcer in the elderly patient When obstruction occurs in the older patient the narrowing of the duodenum is due to cicatricial stenosis which is not amenable to conservative treatment Hemorrhage has been the second most frequent indication for operation in the older patient with duodenal ulcer and accounted for 30 per cent Perforation precipitated surgical intervention in 9 per cent This is a particularly serious complication of duodenal ulcer in the elderly and is associated with a significant mortality rate Four of the nine patients in this series died as a result of the perforation (Fig 13 2)

The presence of associated conditions frequently influences the operative approach as well as the outcome An example of the importance of coexisting disease processes is illustrated by the following case history

CASE REPORT D S (N Y H No 475004)

A 70 year old man had a mole excised from his back elsewhere in 1948 He was admitted to the hospital in July 1950 with complaints of cough and hemoptysis of 6 months duration He also gave a history of recurrent epigastric pain of 5 years duration which was relieved by antacids He was found to have hepatomegaly and roentgenograms of the chest demonstrated multiple densities which were interpreted as *pulmonary metastases* Three days after admission the patient developed sudden severe abdominal pain A perforated duodenal ulcer was plicated Recovery was satisfactory until the third day after oper

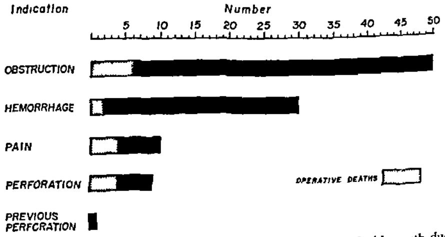


Fig 13 2 Indications for operation in patients 65 years of age and older with duodenal ulcer at The New York Hospital

ation when sudden abdominal pain again appeared. Laparotomy was again performed and the duodenal ulcer was found to have perforated a second time. Evidence of pulmonary infarction was found 2 days later and bilateral femoral vein ligation was undertaken. A massive gastrointestinal hemorrhage occurred 1 week later. The patient succumbed to this complication after 5 days of intensive conservative therapy. Autopsy demonstrated that the hemorrhage had occurred from a chronic duodenal ulcer. The right lung was the site of an abscess with associated empyema and bronchopneumonia. The primary disease process was malignant melanoma with metastases to lungs, liver, adrenals, brain, ileum, jejunum, and lumbar marrow.

This patient illustrates the problem which is associated with the appearance of a complication of duodenal ulcer in the presence of a serious systemic disease. The perforated ulcer was, in essence, the terminal complication of malignant melanoma.

The most frequently encountered associated conditions that are serious threats to the outcome of surgical procedures for older patients with duodenal ulcer are pulmonary and cardiovascular in nature. The coexisting diseases that have been detected among the patients in this series have been tabulated (Table 13.1). The most common problems were arteriosclerotic heart disease, emphysema, benign hypertrophy of the prostate, and generalized arteriosclerosis. This emphasizes the diminished reserve that is present in these patients and indicates the serious consequences of complications after operation.

The importance of associated disease processes in the course of the elderly patient after gastric surgical procedures may be appreciated from a review of the complications that occurred in the postoperative period. There were 18 patients with complications and only 2 of these did not have coexisting disease processes at the time of operation. Among the patients who died following operation, other diseases were recorded in each instance.

The operation of choice in the treatment of duodenal ulcer is generally conceded to be partial gastrectomy. This procedure offers the best protection against recurrent ulceration and can be accomplished with a reasonable mortality rate for patients who are in

TABLE 13.1 COEXISTING DISEASES IN PATIENTS 65 YEARS OF AGE AND OLDER WITH DUODENAL ULCER

	No. of Patients
Pulmonary	
Emphysema	30
Inactive tuberculosis	4
Pneumonia	2
Carcinoma, lung	1
Bronchiectasis	1
Cardiovascular	
Arteriosclerotic heart disease	39
Generalized arteriosclerosis	24
Hypertensive cardiovascular disease	11
Varicose veins	8
Essential hypertension	6
Previous coronary occlusion	2
Rheumatic heart disease	1
Right bundle branch block	1
Auricular fibrillation	1
Congestive heart failure	1
Genitourinary	
Benign prostatic hypertrophy	27
Absent kidney	3
Carcinoma, prostate	1
Uremia	1
Syphilis	1
Gastrointestinal	
Inguinal hernia	22
Diverticulosis	10
Cholelithiasis	9
Colon papilloma	3
Carcinoma, colon	3
Gastric ulcer	3
Epigastric hernia	2
Hiatus hernia	2
Cirrhosis	1
Incisional hernia	1
Hydrops gallbladder	1
Hemorrhoids	1
Intestinal adhesions	1
Duodenal diverticulum	1
Esophagitis	1
Fecal fistula, postoperative appendectomy	1
Other	
Diabetes	5
Nodular goiter	3
Obesity	3
Kyphoscoliosis	1
Epilepsy	1
Tonsilitis	1
Malignant melanoma	1
Hyperthyroidism	1
Hyperparathyroidism	1
Glaucoma	1

satisfactory condition It is, however, important to evaluate each patient carefully Elsewhere in this volume it has been indicated that it is the physical status rather than the chronologic age of the patient that has direct bearing upon the tolerance for operative trauma The nature of the lesion also influences the choice of operative procedure in the surgical therapy of duodenal ulcer In the presence of active bleeding partial gastrectomy provides the most successful results In the presence of a free perforation, plication of the perforation is generally advisable When obstruction is present partial gastrectomy should be undertaken if it can be accomplished with facility However, marked induration or extension of inflammatory changes about the duodenal ulceration has led the authors to accept a less extensive and traumatic approach In such instances posterior gastroenterostomy with concomitant subdiaphragmatic vagotomy can usually be accomplished with less morbidity and a lower mortality rate

The treatment of massive hemorrhage from peptic ulceration in the elderly has been studied in The New York Hospital–Cornell Medical Center by Craver and Glenn In a series of 30 patients 65 years or older the criteria for massive hemorrhage were (1) a hematocrit of 30 per cent or less (2) a hemoglobin level of 10 gm per 100 cc or less (3) a red blood cell count of 3 5 million per cu mm or less and (4) clinical evidence of acute blood loss from the gastrointestinal tract The hazard of blood loss was clearly demonstrated in this study Sixteen of the ulcers lay in the duodenum and 7 were treated by surgical means The danger of myocardial infarction as the result of shock was indicated, and the maintenance of the circulation was found to be the primary point for active and rational therapy The most important measure for prevention of circulatory collapse is the prompt and adequate transfusion of blood In this group of patients the mortality rate was lower in those treated by surgical means

Obstruction of the pylorus from duodenal ulceration is also a threat to the life of the patient The continued loss of gastric juice from vomiting leads to dehydration and alkalosis The diminished extracellular fluid volume that results also causes contraction of the circulating blood volume In addition the failure to ingest adequate quantities of food results in depletion of body protein stores Often the onset of frank clinical pyloric obstruction in the elderly patient is insidious and alkalosis is well established by the time he is admitted to the hospital Careful preparation of these patients for operation is required The stomach becomes large and atonic in many It is recommended that continuous gastric aspiration be instituted in order that the stomach can be decompressed A period of at least 48 hours is usually required Correction of electrolyte imbalance must be undertaken in a vigorous manner at the same time Correction of alkalosis will require the administration of potassium which has been lost in the gastric secretion Replacement of the gastric aspirate is best achieved by the use of a solution that consists of one third 0 75 per cent ammonium chloride and two-thirds normal saline the latter containing glucose

Oral feedings may be cautiously instituted when continuous gastric aspiration is discontinued The authors have had considerable success with an intragastric drip of protein hydrolysate Initially this can be administered at the rate of approximately sixty drops per minute and the stomach is then aspirated for 15 minutes each 3 or 4 hours As the gastric residual decreases the interval between aspirations can be lengthened This method has the advantage of supplying the patient with a source of readily assimilated protein to help rebuild the body protein stores Hourly feedings of milk with antacids at intervals are also useful Atropine and anticholinergic agents are contraindicated in patients with obstruction at the pylorus Many patients with duodenal ulcers and pyloric obstruction will tolerate the liquid feedings which have been outlined above but cannot tolerate more solid food Ac

cordingly, after 7 to 10 days of preparation which may also require blood plasma or both operation is undertaken It is the authors conviction that partial gastrectomy should be performed if feasible If this cannot be accomplished with safety, subdiaphragmatic vagotomy and posterior gastroenterostomy should be performed Simple gastroenterostomy does not appear to afford sufficient protection against recurrent ulceration

Perforation of peptic ulcer is a severe insult to the body economy in the elderly patient It is associated with a high mortality rate The physiologic changes have been well described by Cope and his associates The characteristic response to perforation includes an elevation of the hematocrit which reflects the loss into the peritoneal cavity of fluid rich in plasma Thus fluid therapy should include the administration of plasma Surgical treatment which consists of plication of the perforation should be undertaken early More extensive procedures are not well tolerated by the older patient who has been subjected to the trauma associated with the peritoneal irritation from the perforation

The importance of pulmonary and cardiovascular complications in the period following operation may be seen in Table 13-2 Nine of the postoperative complications involved these systems Four additional patients had urinary tract problems which were related to the frequency of benign prostatic hypertrophy in older men

The causes of death also reflected the debility of the patients and the seriousness of the associated disease processes In patients who had plication of a perforated duodenal ulcer peritonitis was responsible for death in two instances One of these patients (referred to earlier) suffered perforation twice during the same period of hospitalization A cerebrovascular accident led to the death of another patient 5 days after plication Pneumonia was fatal in a fourth

Complications from the technical aspects of partial gastrectomy were responsible for the deaths of two patients In both instances

TABLE 13-2 SURGICAL TREATMENT OF DUODENAL ULCER IN PATIENTS 65 YEARS OF AGE AND OLDER NONFATAL COMPLICATIONS

	No of Patients
Pulmonary	
Pneumonia	2
Pulmonary infarction	1
Cardiovascular	
Thrombophlebitis	2
Coronary occlusion	1
Auricular fibrillation	1
Cardiac arrest	1
Auricular flutter	1
Gastrointestinal	
Intestinal obstruction	1
Gastrointestinal hemorrhage	1
Gastroileostomy	1
Malfunction of stoma	1
Ileus	1
Urinary	
Urinary retention	3
Urinary infection	1
Other	
Wound infection	3
Wound dehiscence	2
Homologous serum jaundice	2

leaking of the duodenal closure occurred In a third a subphrenic abscess was found although there was an absence of evident leak from any portion of the gastrointestinal tract One patient died from a gastrointestinal hemorrhage presumably from the anastomotic suture line Uremia from preexisting renal failure caused the death of another Pneumonia led to death in only one

Among the patients who underwent gastrojejunostomy death occurred predominantly in those with arteriosclerotic changes in the cardiovascular system Cardiac failure cerebrovascular occlusion or myocardial infarction led to death in four of the six patients who died after posterior gastrojejunostomy Pneumonia and pulmonary infarction respectively were responsible for the deaths of the other two patients

It is thus apparent that the hazard of operation is largely related to the condition of the patient and that the most serious factor is the extent of debility produced by degenerative disease processes

Recurrent ulceration has occurred in 15 of the 83 patients who survived operation This was found in 9 patients who had been

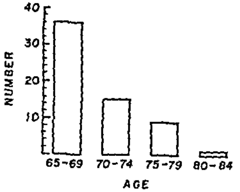


Fig 13 3 Incidence of gastric ulcer in patients 65 years of age and older at The New York Hospital

subjected to posterior gastrojejunostomy and in only 2 in whom a partial gastrectomy had been performed It has been implied that the ulcer disease process is less severe in the older patient, however recurrent ulceration after surgical therapy in 18 per cent of these patients who were 65 years of age or older is strong evidence that the ulcer diathesis is still strong in this age group This is further emphasized by the observation that nine of the recurrent ulcerations appeared in patients who were 70 years of age or older It was also notable that only one marginal ulcer occurred among 34 patients who underwent a gastrectomy in which two thirds or more of the stomach was resected while three jejunal ulcers later appeared among 20 patients in whom less than two thirds was removed Thus in the elderly as in the younger patients the most adequate surgical treatment that is in keeping with the general conditions of the patient should be undertaken It is the assessment of the general clinical status of the patient that must largely determine the extent of the operation

GASTRIC ULCER

Gastric ulcer presents many contrasts to duodenal ulcer both in pathogenesis and in clinical behavior The work of Dragstedt has done much to elucidate the physiologic processes of gastric secretion which are involved in the development of gastric ulcer He has presented extensive clinical experimental evidence to support the concept that most gastric ulceration is the result of the hypersecretion of gastric juice due to antral hyperfunction Clinically the predominance of males is much less striking in gastric ulcer than in duodenal ulcer The majority of gastric ulcers appear later in life than do duodenal ulcers Frequently the duration of symptoms is considerably briefer than is recorded with ulceration of the duodenum

The authors' experience in the treatment of gastric ulcer in patients 65 years of age or older is based on observations made on 61 patients who underwent surgical therapy Thirty six were men, and 25 were women The age distribution is presented in Fig. 13-3 A striking difference in duration of symptoms is to be noted In this group, 32 patients experienced symptoms for 1 year or less preceding operation and 15 were found to have symptoms that antedated operation from 1 to 5 years Only 6 had symptoms for more than 10 years

The management of patients with gastric ulceration is complicated by the problem that the lesion might be malignant The difficulty in establishing whether the process represents a benign or a malignant disease is well known This question played a role as an indication for operation in 36 of 61 patients In 13 it was felt that the ulcer might well be carcinoma In 23 instances the gastric ulcer persisted sufficiently long to arouse suspicion although the customary laboratory determinations indicated that the lesion was benign The appearance of a gastric ulcer in an older patient should arouse a strong suspicion of the presence of cancer although it is apparent from even this limited experience that most of these ulcerations are not malignant when their appearance and findings suggest benignity

The propensity toward hemorrhage is well established in the authors experience Hemorrhage was the most frequent symptom which resulted in operative intervention and exceeded obstruction perforation and persistent pain as an indication Significant hem

orrhage occurred in 21 per cent of the patients in this series These findings, together with the incidence noted for duodenal ulcer seem to corroborate the findings of Ivy and associates that an ulcer which appears late in life is more likely to bleed than one that appears early It is also in keeping with the often stated clinical observation that gastric ulcers tend to bleed more frequently than duodenal ulcers It was also found that gastric ulcer is less likely to perforate in the older age groups than is duodenal ulcer

Little need be added in reference to the occurrence of associated diseases in the presence of gastric ulcer The incidence of degenerative diseases which involve the cardiovascular and pulmonary system is much the same as that described for duodenal ulcer in this age group

Partial gastrectomy is the operation of choice for gastric ulcer This operation has the advantages of (1) controlling the disease process especially if hemorrhage has occurred (2) permitting histologic examination of the ulcer and (3) removing the antrum which appears to have importance in the pathogenesis of gastric ulcers In this series of 61 patients partial gastrectomy was accomplished in 53 instances with seven deaths Three of these deaths occurred in patients in whom hemorrhage precipitated surgical intervention Proximal gastrectomy was performed in 2 patients who had large ulcers in the upper portion of the stomach Both patients survived Gastroenterostomy was undertaken in 3 of whom 1 failed to survive Gastroenterostomy is not recommended because the ulcer is not removed This procedure does not permit microscopic examination of the ulcer and also is not satisfactory when hemorrhage is the indication for operation However it is of interest that recurrent or stomal ulceration did not occur in either of the surviving patients which is in keeping with the hypothesis of Dragstedt that hyperfunction of the antrum is a significant factor in the pathogenesis of gastric ulceration

In general the operation for gastric ulcer is a less formidable procedure than that for duodenal ulcer The other organs and systems of the body are not subjected to the same amount of stress This is reflected in the pattern of complications that occur after operation Only 3 of the 11 patients with nonfatal complications had complications that could be attributed to defects in other parts of the body namely urinary retention pulmonary edema and pneumonia The remaining eight complications were related to the technical aspects of the operation

In contrast of the eight deaths only one could be directly attributed to the technical aspects of the operative procedure In this patient a 75 year old female with hypertensive cardiovascular disease who had been operated upon because the gastric ulcer was suggestive of being malignant obstruction to the afferent loop of the gastrojejunostomy was followed by pancreatic necrosis wound infection and pneumonia The other seven patients succumbed to complications that were set in progress by the ulcer and complicated by the general clinical condition Three patients in whom partial gastrectomy had been undertaken for bleeding died as a result of the disturbed cardiovascular status which was precipitated by the hemorrhage Two died from shock and one from a coronary occlusion

MARGINAL ULCER

Although marginal ulceration is encountered less often than are primary ulcers of the stomach or duodenum these lesions raise definite problems in management Marginal ulcers are seen more frequently in men than in women This is because they more often follow operations for duodenal ulcer than for gastric ulcer In a group of 28 patients who were admitted to The New York Hospital–Cornell Medical Center because of marginal ulceration 22 were men and 6 were women The original site of the ulceration for which operation had been performed was in the duodenum in all but 1 patient.

TABLE 13 3 SYMPTOMS OF MARGINAL ULCERATION IN PATIENTS 65 YEARS OF AGE OR OLDER

Symptoms	*No of Patients*
Hemorrhage	14
Pain	12
Gastrojejunocolic fistula	2
Obstruction	1

Marginal ulceration produces hemorrhage or pain as the predominant symptom in the majority of elderly patients In the authors' experience these two symptoms have appeared with approximately equal frequency among those who required admission to the hospital (Table 13 3)

The interval at which symptoms of marginal ulceration occur after the original operation varies greatly In the majority of the patients in the elderly age groups more than 1 year elapsed before evidence of marginal ulcer developed In seven of the patients in this series more than 10 years had passed after the original procedure before the marginal ulcer became apparent In two more than 20 years had intervened

Marginal ulceration is seen most frequently after posterior gastrojejunostomy Among the group of 28 patients reviewed the original operation in 24 was a posterior gastrojejunostomy In 3 a conventional partial gastrectomy had been performed and in 1 a Billroth II Symptoms of marginal ulceration are more likely to occur within a relatively brief period of time after partial gastrectomy than after posterior gastrojejunostomy

The age distribution of the patients with marginal ulceration who were admitted to

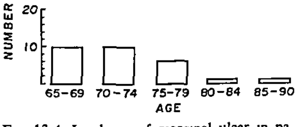


Fig 13 4 Incidence of marginal ulcer in patients 65 years of age and older at The New York Hospital

the hospital for treatment is given in Fig 13 4 Of the 28 patients, 20 were between the ages of 65 and 75 years, and the oldest was 89 years old

A variety of procedures have been employed in the treatment of marginal ulceration There is justified reluctance to subject an elderly patient to a secondary operation for peptic ulceration if satisfactory results can be obtained by conservative means The decision to treat the patient by surgical or medical means is often difficult If hemorrhage has occurred, surgical intervention is usually indicated Although exsanguinatin hemorrhage is less common in marginal ulceration than in duodenal or gastric ulcers, it is still a significant hazard In the present series of marginal ulcers 15 patients were treated medically, and 2 of these died of hemorrhage The dangers of hemorrhage are the same as those outlined in the section on Duodenal Ulcer

Conservative management has resulted in relief of ulcer symptoms in only 3 of the group of 15 in which this form of therapy was undertaken One of the 3 has been followed for more than 5 years One has been well for more than 3 years after parathyroidectomy for hyperparathyroidism which was discovered at the time the patient was admitted for treatment of the marginal ulceration

In general the same principles of management apply to marginal ulcers that have been outlined in the preceding portions of this chapter If the indications for operation are present surgical treatment yields superior results when compared to conservation management If a marginal ulcer occurs after posterior gastrojejunostomy the most satisfactory results are obtained by dismantling the anastomosis and performing a partial gastrectomy Marginal ulcer after partial gastrectomy is usually best treated by vagotomy The management of gastrojejunocolic fistula offers certain problems because malnutrition often accompanies this lesion Preoperative preparation with parenteral fluids which should include protein hydrol

ysates and blood or plasma has been beneficial in the authors experience A period of 10 days to 2 weeks of parenteral alimentation has permitted primary resection of the fistula without mortality in the past several years

BIBLIOGRAPHY

Cope O Hopkirk J F and Wight A The Metabolic Derangements Imperiling the Perforated Ulcer Patient I The Dehydration and Fluid Shifts A M A Arch Surg 71 669 1955

Craver W L and Glenn F Massive Hemorrhage from Peptic Ulcer A Cause of Myocardial Infarction in the Aged J Am Geriatrics Soc 5 969 1957

Dragstedt L R Oberhelman H A Jr Evans S O and Rigler S P Antrum Hyperfunction and Gastric Ulcer Ann Surg 140 397 1954

Ivy A C Grossman M I and Bachrach W H *Peptic Ulcer* McGraw Hill Book Company Inc Blakiston Division New York 1950 pp 469 616 847

14

Cancer of the Stomach

John M Beal

CARCINOMA

Carcinoma is the most common malignant neoplasm of the stomach accounting for about ninety five per cent of gastric cancer and appearing in men more frequently than in women In a group of 188 patients 60 years or older at The New York Hospital–Cornell Medical Center, 116 were men and 73 were women Gastric carcinoma is predominantly a disease of the later years of life, and more than 60 per cent of the cases occur after the age of 60 Malignant neoplasms of the stomach are exceeded only by those of the large intestine

The Bureau of Vital Statistics reported for 1955 a death rate from gastric cancer of 104 8 per 100 000 population in the 50 to 59 group and 168 6 from ages 60 to 64 In the group 80 to 84 this figure increased to 611 8

Symptoms

Abdominal pain is the most common symptom among patients with gastric cancer The pain usually centers around the epigastrium and is frequently described as vague indigestion The patient will often complain of dull persistent abdominal distress which is frequently exacerbated by the ingestion of food In some instances the discomfort is produced by eating These complaints are followed by a decreased oral intake with resultant loss of weight A smaller group, 10 to 15 per cent, experiences epigastric pain resembling that which is associated with peptic ulceration These patients report alleviation of these symptoms when food milk or alkali is ingested Among this group some may report initial relief of abdominal distress with ulcer therapy which later becomes ineffectual

Symptoms which result from bleeding are the presenting complaints in other patients and appearance of hematemesis or melena may cause them to seek medical attention Weakness, dyspnea and occasionally angina may result from moderate or marked anemia from loss of blood through the gastrointestinal tract When older persons have unexplained anemia of the secondary or hypochromic type a malignant lesion of the gastrointestinal tract should be suspected If tests of the stools are positive, gastrointestinal roentgenograms should be obtained

Nausea and vomiting which occur frequently are particularly severe among those patients in whom obstruction of the stomach is present This reflects in part the frequency with which carcinoma attacks the antrum Dysphagia may be associated with carcinoma of the gastric cardia and occurs when there is impingement upon or involvement of the esophagogastric junction or invasion of the distal portion of the esophagus In some patients with dysphagia differentiation between carcinoma of the stomach and of the esophagus can be established only by microscopic examination

Physical Examination

Evidence of weight loss is usually appar ent at the time of physical examination A careful history should elicit the amount of weight loss and its duration and should seek evidence of malnutrition avitaminosis and anemia Clinical evaluation is as important as laboratory studies in assessing the patient for operation A loss of 20 or 30 lb over a period of 3 or 4 weeks indicates a significant depletion of body protein stores despite nor mal serum protein levels

Because degenerative diseases of the car diovascular system increase with age these may superimpose serious problems on that of the gastric neoplasm The presence of pulmonary or myocardial insufficiency hy pertension or renal disease may well play a decisive role in the selection of the type of operative procedure that will be employed (Table 14 1)

Dissemination of the malignant process may be manifested by secondary involve ment of peripheral nodes The classical in volvement of the left supraclavicular node (Virchow s node) is seldom found In the author s experience only 5 of the 189 pa tients had peripheral lymph node involve ment and in only 2 of these did biopsy of the left supraclavicular node demonstrate metastatic carcinoma

An abdominal mass may be felt and this finding has frequently raised some doubt concerning the advisability of surgical inter vention Approximately one third of the pa tients with gastric cancer have an abdominal mass Although the presence of such a mass makes it less likely that a definitive proce dure can be carried out it does not signifi cantly alter the survival rate if resection can be performed

Careful rectal examination should seek to detect intraperitoneal dissemination of neo plastic cells to the cul-de sac (Blumer s shelf) Fortunately this ominous finding is seldom encountered and was present in less than 1 per cent of these cases Ascites is also

Table 14 1 Associated Diseases

	No of Patients
Cardiovascular	
Arteriosclerotic heart disease	11
Hypertensive cardiovascular disease	11
Generalized arteriosclerosis	6
Hypertension	4
Varicose veins	4
Coronary occlusion	2
Cerebral vascular accident	1
Enlarged heart	1
Cardiac failure	1
Pulmonary	
Emphysema	6
Bronchiectasis	1
Gastrointestinal	
Cholelithiasis	5
Diverticulosis	2
Malnutrition	2
Rectocele	1
Subdiaphragmatic abscess	1
Enteric fistula	1
Genitourinary	
Benign prostatic hypertrophy	10
Hydrocele	3
Cystocele	1
Endocervical polyp	1
Late latent lues	1
Secondary carcinoma	
Right breast	2
Liver	1
Colon	1
Cervix	1
Miscellaneous	
Inguinal hernia	5
Pernicious anemia/combined degeneration	5
Chronic otitis media	4
Osteoarthritis	4
Nodular goiter	3
Diabetes mellitus	3
Senile cataracts	2
Atrophy of calf muscles	1
Pes cavus spastic	1
Paget s disease	1
Chronic sinusitis	1
Exogenous obesity	1
Dehydration	1

a sign of inoperability if tumor cells are found in the ascitic fluid

Pathogenesis

The causes of gastric cancer, like those of cancer in general remain obscure It is obvious that significant improvement in cure must await deeper understanding of the etio logic factors Considerable investigation has been carried out and many facets remain controversial While there seems to be a

hereditary trait in some families this has been difficult to establish statistically and has been questioned by many The relationship between gastric ulcer and gastric cancer has been studied but gastric ulcer has not been yet established as a precancerous or premalignant lesion The principal problem remains distinguishing a benign from a malignant gastric ulcer In this regard, Alvarez has stated 'It is always unwise to diagnose an early benign gastric ulcer in an elderly person An ulcer that appears for the first time at age 60 is likely to be cancerous

Gastric papillomas, however do appear to be related to gastric cancer Although it is difficult to establish the precise incidence of degeneration of benign gastric papillomas in gastric cancer it is likewise difficult to determine which polypoid lesions are benign and which are malignant While gastric papillomas are not frequent precursors of carcinoma of the stomach, they should be surgically removed

Since gastric carcinoma has been found to develop with increased frequency in patients with pernicious anemia these individuals should have periodic examinations of the upper gastrointestinal tract and their stools should be tested for occult blood

Laboratory Findings

Anemia may or may not appear in patients with gastric cancer The degree of anemia is largely related to the loss of blood from the neoplasm, although in some patients malnutrition plays an important role Approximately 50 per cent may be expected to have hemoglobin levels below 11 Gm If massive hemorrhage has occurred the degree of anemia may be much more pronounced

Examination of the stools is a valuable diagnostic aid in the detection of gastric cancer Positive laboratory tests for blood in the stools have been found in 80 per cent or more of these patients Persons with hypochromic anemia and with persistent blood in the stools should be thoroughly investigated for gastrointestinal malignancy since both are found with significant frequency in carcinoma of the stomach and of the proximal colon

Gastric analysis has received considerable attention as an aid in diagnosing malignant lesions of the stomach It has long been recognized that hypochlorhydria or achlorhydria occurs with great frequency in patients with gastric cancer Approximately 90 per cent of patients over 60 years of a with carcinoma of the stomach have a diminished response or none at all to the administration of histamine Approximately 30 per cent of the population at the age of 60 years have achlorhydria and this incidence increases with age Therefore there appears to be a definite relationship between achlorhydria and gastric cancer For this reason it has been suggested that gastric analysis be employed as a screening test in detecting gastric cancer The finding of achlorhydria after histamine administration in association with occult blood in the stools should lead to prompt and thorough study of the stomach for cancer

Study of gastric specimens by the techniques of exfoliative cytology has increased the accuracy of diagnosis of stomach lesions but its role in the detection of early cancer is still to be determined However when it is employed in conjunction with other clinical and laboratory studies this method offers strong diagnostic assistance Seybolt and Papanicolaou reported positive results for cancer in 66 per cent of 117 cases of gastric cancer which they studied and results suspicious of cancer in 19 per cent Only one false positive report occurred in 485 cases

Radiologic study of the upper gastrointestinal tract remains the most widely employed diagnostic method for the detection of gastric cancer When performed by a capable radiologist few lesions are overlooked It is important to remember that frequently the radiologist cannot identify the precise nature of early lesions and may not be able to state that a defect in the stomach is or is not carcinoma In this event additional examinations must be performed and the roentgeno

grams interpreted in the light of other clinical and laboratory findings In a patient beyond 60 years of age particularly in a man the findings of a gastric defect stools which contain occult blood, and achlorhydria are strongly suggestive of gastric cancer and should be sufficient evidence for surgical intervention

Endoscopic examination is a valuable diagnostic adjunct in certain situations Gastroscopy has not proved sufficiently valuable to employ routinely Little seems to be gained from subjecting to gastroscopy patients in whom roentgenographic studies have demonstrated filling defects or in whom cytologic reports are positive in the presence of gastric ulceration Gastroscopy should be limited to those patients in whom the other diagnostic methods are inconclusive or indeterminate Esophagoscopy on the other hand, is indicated in patients with dysphagia Where the lower esophagus is involved in a neoplastic process it is important to establish the type of lesion Often gastric carcinoma invades the distal esophagus and esophagoscopic biopsy can distinguish between epidermoid carcinoma and adenocarcinoma in this location This distinction may be important in the surgical approach to the tumor

Certain other laboratory determinations may be indicated In patients who have had persistent vomiting attention must be given to the fluid and electrolyte status Prolonged weight loss may result in hypoproteinemia Blood volume determinations have proved helpful in assessing the relative deficiency of red cells and plasma elements in such patients A more complete discussion of the evaluation of such patients has been covered in an earlier chapter (Chap 3)

Treatment

In the treatment of gastric cancer the principal concerns are (1) the extent of the disease process (2) the degree of malnutrition and (3) the nature and severity of associated disease processes If extension of the malignant process to peripheral lymph nodes pulmonary parenchyma or ascitic fluid can be demonstrated it is obvious that definitive surgical treatment cannot be carried out

The depletion of body stores has therapeutic significance because many of the complications that increase morbidity and mortality have their inception in this loss Failure of anastomoses to heal properly can often be attributed to hypoproteinemia Resistance to infection is weakened in those whose body protein stores are diminished The best guide to depletion of body protein is the clinical history of significant loss of body weight The loss of body protein may continue for a variable period of time before serum protein levels become depressed Thus in patients who have obstructing lesions or who have had sufficient anorexia to cause a marked weight loss, the body stores should be repleted before operation Improvement can often be achieved by supplementing oral intake with intravenous administration of protein hydrolysate intravenous fat emulsions albumin or plasma and whole blood, if anemia is present A preparatory period of 7 to 10 days will usually result in sufficient improvement to permit the patient to withstand the postoperative catabolic phase and to have fewer complications In the patient who is able to take even limited oral feedings the problem of improvement of hydration and of correction of nitrogen and hemoglobin deficits is less difficult When pyloric obstruction is present the problem is indeed formidable and limited improvement is usually all that can be attained

Because surgery offers the only hope of cure the goal is early diagnosis and prompt operation Complicating disease processes, such as myocardial insufficiency renal impairment and pulmonary insufficiency increase the operative hazard However though the risk is increased an attempt should be made to remove obvious malignant gastric lesions unless there is evidence of distant metastases

Age alone is not a deterrent to operative treatment Marshall cited an experience in which an 89 year-old patient was subjected

to partial gastrectomy for cancer of the stomach and lived to reach the age of 95 The mortality differs little between patients prior to and beyond the age of 60 years With increase in age it is advisable to restrict the radical nature of the procedure as far as is commensurate with adequate excision although total gastrectomy is still feasible when indicated It is preferable to accomplish such extended procedures without entry into the thoracic cage if this can be done without limitation of exposure and with adequate excision

Complications

The most frequently encountered complications after operation have been pulmonary in nature (Table 14 2) The single most frequent complication has been pneumonitis Other pulmonary complications have included pleural effusion, pulmonary infarction empyema, atelectasis and pneumothorax Adequate ventilation and assiduous oropharyngeal and tracheal suction in the immediate postoperative period accomplish much in the prevention of pulmonary complications and early ambulation is a valuable adjunct

TABLE 14-2 NONFATAL COMPLICATIONS AFTER OPERATION

	No of Patients
Cardiovascular	
Thrombophlebitis	4
Auricular tachycardia	1
Auricular fibrillation	1
Sinus tachycardia	1
Cerebrovascular accident	1
Pulmonary	
Pneumonitis	5
Pleural effusion	3
Pulmonary infarct	2
Empyema	1
Atelectasis	1
Pneumothorax	1
Gastrointestinal	
Subdiaphragmatic abscess	2
Generalized peritonitis	2
Gastric retention	2
Paralytic ileus	1
Stomatitis	1
Perforation	1
Miscellaneous	
Penicillin rash	1
Wound infection	1
Separation of skin incision	1

Gastrointestinal and cardiovascular complications have occurred with approximately the same incidence Among the latter thrombophlebitis has been seen most often Signs of myocardial irritability have been manifested by auricular tachycardia or fibrillation Cerebrovascular accidents may be encountered, particularly in those in whom circulatory abnormalities occur Intraabdominal infection has been a definite factor in increasing morbidity among patients who are subjected to gastric operations for cancer Peritonitis and subdiaphragmatic abscess have accounted for more than one half of intraabdominal complications in this series Abscesses and peritonitis have developed without evidence of leakage from anastomoses and are probably related to the presence of virulent organisms in the gastrointestinal tract of debilitated patients Leaking suture lines are more common after resections for cancer than for ulcer a phenomenon that is probably related to the depleted state of the patient rather than to the extent of resection A period of repletion of the patient s body stores before operation may improve healing of the incision and suture line

In contrast to the pattern of nonfatal complications most of the deaths after operation in this series have resulted from intraabdominal problems Pulmonary complications have ranked second as a cause of mortality and cardiovascular complications third The predominant cause of death has been peritonitis and usually this has been due to separation of an anastomosis In one instance hemorrhage into the mesentery of the transverse colon caused loss of viability of this segment of colon with peritonitis and death It is important that anastomoses be free of tension and that the opposing portions of the bowel be viable The only fatality which resulted from a leak of an esophagoduodenal anastomosis was in all probability the result of excessive tension Interposition of a segment of jejunum between the esophagus

and the duodenum might have prevented this catastrophe

Myocardial infarction resulted in the death of two patients after total gastrectomy It is likely that a less extensive operation might have been attended by recovery, although both patients had evidence of arteriosclerotic heart disease Because of such occurrences, it has been found advantageous in the older patient to accomplish total gastrectomy through an abdominal incision when this is technically feasible In addition, partial gastrectomy is a safer procedure in the presence of myocardial insufficiency Unfortunately in some patients the entire stomach must be removed if there is to be any hope of extirpating the disease, and in these the hazard is greater

Operative Mortality

Despite the frequency of associated degenerative diseases in this older group of patients the operative mortality has been similar to that for all age groups The operative mortality for 163 patients at The New York Hospital who were 60 years of age or older was 15, or 9 2 per cent Beal and Hill in 1956 reviewed the experience in the surgical treatment of *all* patients with gastric carcinoma at The New York Hospital and found an operative mortality of 10 7 per cent for 187 patients who were operated on between 1942 and 1954 This experience parallels the findings of Marshall and Warren who stated that the operative risk in patients with gastric cancer is not greater in individuals 60 years of age or older than in the younger group

Analysis of the causes of death after operation for gastric cancer in The New York Hospital series discloses that 5 of the deaths occurred after exploratory laparotomy in patients with inoperable cancer The remaining 10 deaths occurred among 112 patients who were subjected to some type of resection (Table 14 3) There were 4 deaths among 66 patients who were treated by partial gastrectomy and the same number succumbed among 37 patients in whom total

TABLE 14 3 TREATMENT OF CARCINOMA OF THE STOMACH IN PATIENTS 60 YEARS OF AGE AND OLDER

Procedure	*No of patients*	*Lost operative deaths*
No operation	26	
Exploratory laparotomy	40	5
Gastrojejunostomy	11	0
Partial gastrectomy	66	4
Esophagogastrectomy	8	2
Total gastrectomy	37	4
Total	188	15

gastrectomy was undertaken Although partial gastrectomy is associated with a lower mortality rate it is also apparent that total gastrectomy can be performed with a reasonable survival rate For this reason, the author has had no reservations about performing total removal of the stomach in the older age groups if such a procedure is indicated by the size and location of the neoplasm (Table 14 4)

The largest group of fatal complications have been intraabdominal in origin Approximately half the complications that led to death after operation were attributed to technical aspects of the procedure Leaks from anastomoses led to peritonitis intraperitoneal abscess and death in 3 of the 10 Tension on the suture line appeared to play a role in the separation of the anastomosis in 2 of these Hypoproteinemia may also contribute to failure of the suture line to heal It is essential that both segments of the gastrointestinal tract that are used for the anastomosis have an adequate blood supply

Prognosis

Failure to remove the malignant neoplasm is followed by death after a short interval In this group only one patient survived for more than 1 year after exploratory laparotomy without resection or posterior gastrojejunostomy Thus resection offers the only

TABLE 14-4 OPERATIVE MORTALITY BY AGE GROUPS FOR PATIENTS IN THE ELDERLY AGE GROUP WITH CARCINOMA OF THE STOMACH

Operation	Age groups					
	60–69		70–79		80–89	
	No	Operative deaths	No	Operative deaths	No	Operative deaths
Gastrojejunostomy	4	0	7	0	0	0
Partial gastrectomy	38	1	25	2	3	1
Esophagogastrectomy	5	0	3	2	0	0
Total gastrectomy	33	4	4	0	0	0
Total	80	5	39	4	3	1

chance of prolonged survival in patients with carcinoma of the stomach

The prognosis for the elderly patient seems to differ little from that of the younger person with gastric cancer For the entire group of 188 patients 60 years of age or older 13 (6 9 per cent) survived 5 years or longer a rate that is approximately the same as that for patients in general with carcinoma of the stomach who are treated by gastrectomy The 13 patients who were alive for 5 or more years after surgical removal of the gastric carcinoma were among 60 patients who were eligible for 5 year survival computation This represents a 5 year survival rate of 21 7 per cent after gastrectomy (Table 14-5) McNeer and his associates indicated that their findings demonstrated an increase in curability in the elderly patient however the author s findings do not support this observation More important than this discrepancy is the fact that a significant number of patients will survive after removal of the malignant gastric neoplasm while failure to accomplish extirpation of the cancer leads to an early death

TABLE 14 5 RESULTS OF TREATMENT OF CARCINOMA OF THE STOMACH IN ELDERLY PATIENTS (5-YR SURVIVAL AFTER RESECTION)

Procedure	No	5 yr survivors
Partial gastrectomy	42	11
Esophagogastrectomy	8	1
Total gastrectomy	10	1
Total	60	13

* Based on number of patients who are eligible for 5 yr survival and who survived operation

SARCOMA

Sarcoma represents approximately five per cent of malignant neoplasms of the stomach and of these about three fourths are lymphomas The remainder are largely leiomyosarcomas while other types such as fibrosarcoma and myxosarcoma are occasionally encountered The age distribution in general resembles that of carcinoma

Gastric Lymphoma

The symptomatology of gastric lymphoma resembles that associated with carcinoma of the stomach Abdominal pain weight loss and gastrointestinal bleeding are the most common symptoms Physical findings do not aid in the differential diagnosis and laboratory aids have not been helpful in distinguishing these lesions from carcinoma Hematologic study gastric cytologic tests

and gastric analysis have not been determinate in the author's experience. A diagnosis of lymphoma of the stomach was made in 4 of 33 patients in whom gastrointestinal roentgenograms were made. Thus the diagnosis prior to operation has usually been carcinoma. The precise nature of these neoplasms is often not recognized even at the time of operation.

The gross character of lymphoma may suggest its presence if the rather soft rubbery consistency of the neoplasm is detected. Lymphoma should also be considered if the gastric cancer is large and bulky but without hepatic metastases. Lymphadenopathy is deceptive. Although the majority of the patients in this series were thought to have secondary involvement of the regional lymph nodes, in only 47 per cent were metastatic deposits found when microscopic study was made.

Surgical removal of malignant lymphoid neoplasms of the stomach should be undertaken whenever possible, even though there may be uncertainty as to the completeness of removal. Survival for more than 5 years after operation has occurred in patients with neoplastic extension to the line of transection of the stomach. Treatment with roentgentherapy is recommended in the postoperative period for patients with gastric lymphoma.

The prognosis for these patients is better than for those with carcinoma of the stomach. Of the patients who survived operation 59 per cent were alive 5 years or longer after curative operation.

Other Gastric Sarcomas

The propensity to hemorrhage is notable in this group of neoplasms and such bleeding is often massive. Gastrointestinal bleeding led to admission to the hospital in 11 of 13 patients in the group seen at The New York Hospital. Epigastric pain, though often present, is not as prominent a symptom as in the gastric cancers which have been discussed. An abdominal mass was present in 8 of the 13 patients and in 2 was the presenting complaint.

A radiologic diagnosis of leiomyosarcoma is occasionally made when a smooth concentric filling defect can be observed.

At the time of operation, the gross appearance of a leiomyosarcoma is reasonably typical. Differentiation between leiomyosarcoma, fibrosarcoma and myxosarcoma requires microscopic study. These neoplasms are usually bulky, lobulated and vascular. One in this series measured 33 cm in diameter and larger tumors have been reported. The attachment to the gastric wall may be small in proportion to the size of the tumor mass. Direct extension to adjacent organs, regional lymph node metastasis and hepatic metastasis may occur.

Surgical excision is required if hope of cure is to be entertained. Radiation therapy is of little avail in this group of neoplasms. Often a rather limited resection of the stomach is adequate, particularly when the site of origin of the sarcoma is limited to a small area of the gastric wall. Even though excision is incomplete, some patients may survive for prolonged periods. In one patient in this series recurrence did not cause death until 6 years after operation. Six of ten patients in this group lived more than 5 years after definitive operation.

BIBLIOGRAPHY

Alvarez, W. C.: Gastrointestinal Disorders in the Elderly. Geriatrics 12: 696, 1957.

Beal, J. M., and Hill, M. R., Jr.: An Evaluation of the Surgical Treatment of Carcinoma of the Stomach. Surg. Gynec. & Obst. 102: 271, 1956.

Cromer, H. E., Jr., Comfort, M. W., and Butt, H. R.: Gastric Acidity in Cases of Adenomatous Gastric Polyps. J. Nat. Cancer Inst. 10: 497, 1949.

Marshall, S. F., and Warren, K. W.: Some Aspects of the Gastric Cancer Problem. J. Am. Geriatrics Soc. 2: 377, 1954.

McNeer, G., Lawrence, W., Jr., Ashley, M. P., and Pack, G. T.: End Results in the Treat

ment of Gastric Cancer Surgery 43 879 1958

Seybolt J F and Papanicolaou G N The Value of Cytology in the Diagnosis of Gastric Cancer Gastroenterology 33 369 1957

Shahon D B Horowitz S and Kelly W D Cancer of the Stomach An Analysis of 1152 Cases Surgery 39 204 1956

Thorbjarnarson B Pearce J M and Beal J M Sarcoma of the Stomach Am J Surg 97 36 1959

15

Acute Appendicitis

Bjorn Thorbjarnarson

Appendicitis has become a well known and common entity since Reginald Fitz of Boston described it and typhlitis as the same disease in 1886 It afflicts all age groups and both sexes although there is some preponderance among males With increasing longevity the incidence of appendicitis in the older age groups is rising Thus in The New York Hospital during the years 1932 to 1937 only 1 per cent of the 886 patients with acute appendicitis were older than 60 During the years 1952 to 1957 in a total of 516 patients however this figure rose to 8 4 per cent During the last quarter of a century there has been a marked increase in the percentage of older persons who die from appendicitis (Table 15 1) The distribution according to age among 134 patients over the age of 60 with acute appendicitis is shown in Table 15 2 This rise in incidence in the older age group reflects both an increase in the number of elderly patients and a decrease in the number of younger persons with appendicitis (Table 15 3) The decrease in incidence of appendicitis in the total population has also been noted elsewhere The mortality from appendicitis has steadily decreased from 15 2 per 100 000 population in 1925 to 1 4 in 1955

ETIOLOGY

Appendicitis in the aged often presents a clinical picture different from that which is seen in younger persons A prominent factor in this is perforation with localized or spread ing peritonitis which is found in over two-thirds of the older patients compared with about one fifth for all age groups combined The increased incidence of perforations in the older age groups has been blamed on delay in hospitalization although this is not always apparent and probably is not an important factor Thus in this series the duration of symptoms before admission was found to be 2 6 days in both the total group and in those over 60 and 65 per cent of the older patients were admitted during the first 48 hours of their illness The number of

TABLE 15-1 DEATHS FROM APPENDICITIS IN OLDER PERSONS

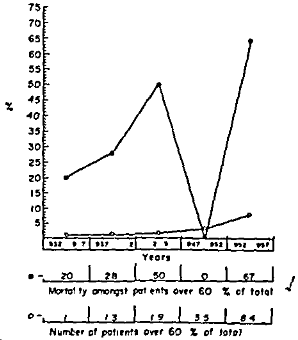
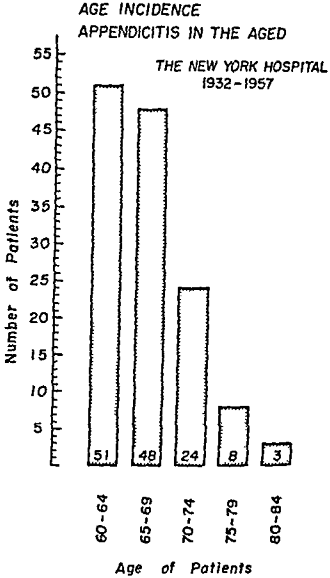


TABLE 15-2 AGE INCIDENCE OF APPENDICITIS IN PATIENTS OVER SIXTY YEARS



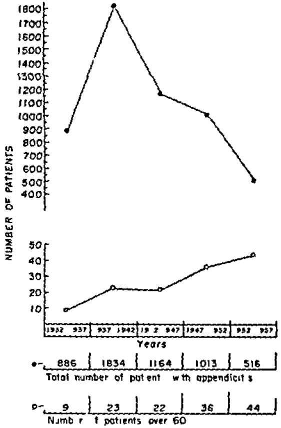
elderly persons entering the hospitals with long standing abscesses unduly influences the estimated duration of symptoms for the group as a whole When only the nonperforated cases are considered the duration of symptoms is found to be about the same for both age groups Other factors influence the type of appendicitis encountered in the older age groups and apparently determine the frequency of perforations Among children and young adults a connection has been apparent between upper respiratory infections and appendicitis The marked decrease in appendicitis in this age group may have been partially caused by the use of antimicrobial agents for the upper respiratory infections in particular drugs which also are effective against the intestinal flora This antimicrobial therapy thus also aleviates the appendicitis a process which frequently is primarily a bacterial one Among the older group however factors predisposing to perforation are more common and primary bacterial infection of the appendix play a less significant role Arteriosclerosis with decreased blood supply to the organ fibrosis and diminished resistance to infection are frequently seen Brotherus found marked arteriosclerotic changes in 32 of 50 appendixes which had perforated in persons over 50

Investigations of perforated appendixes in younger patients revealed these changes to be much less frequent or twice in every 17 cases Normal appendixes removed at autopsy or during unrelated procedures in these age groups showed the changes in similar proportions The normal anatomy of the appendix in the older age group often reveals the lumen to be narrowed and sometimes obliterated The mucosa is thin lymphoid elements have largely disappeared and there is fibrosis and fatty infiltration of the muscular wall and sclerosis of both arteries and veins (Fig 15 1) Arteriosclerosis and phlebosclerosis with decreased blood supply to the organ predispose to stasis and thrombosis Both of these changes are common and almost physiologic among the older age groups and as cited above are found much more frequently in association with destructive appendicitis and peritonitis in the older age group than in younger persons Previous attacks of appendicitis often have left behind strictures favoring obstruction of the lumen and fecoliths are frequently found In this series over 25 per cent of the patients had well formed fecoliths The elements of impaired blood supply intraluminal obstruction and structural weakness of the wall are the principal factors in producing early perforation in the older age group and explain why this so often happens with minimal symptoms Often the blood supply to the appendix is so poor that only slight obstruction is required to produce edema and vascular thrombosis and so to set the stage for gangrene and perforation The intraluminal pressure required to shut off the blood supply is in direct proportion to the condition of the blood vessels and the resiliency of the appendiceal wall The violent crampy pains associated with obstructive appendicitis in youth may therefore never become apparent in the older person

SYMPTOMS AND SIGNS

Mortality from appendicitis in the last 15 years occurred mainly among elderly persons with perforation The cause of the frequency of perforations has been alluded to and improvement in the present status of affairs requires a different approach in diagnosing the disease in older patients The ease with which the organ with poor blood supply may become perforated explains how this often occurs apparently early in the course of the disease and with minimal signs and symptoms All too frequently the patients are first seen with the clinical picture of generalized peritonitis or intestinal obstruction without any suggestion of the origin of the process Although pain is the most constant and reliable symptom and is found in the majority of patients this differs considerably from the classical description (Table 15-4) Only rarely do patients complain of upper or generalized abdominal pain which localizes in the right lower quadrant within 12 hours The pain is often dull sometimes described as a feeling of distention Although

TABLE 15-3 DECREASE OF APPENDICITIS IN YOUNGER PERSONS



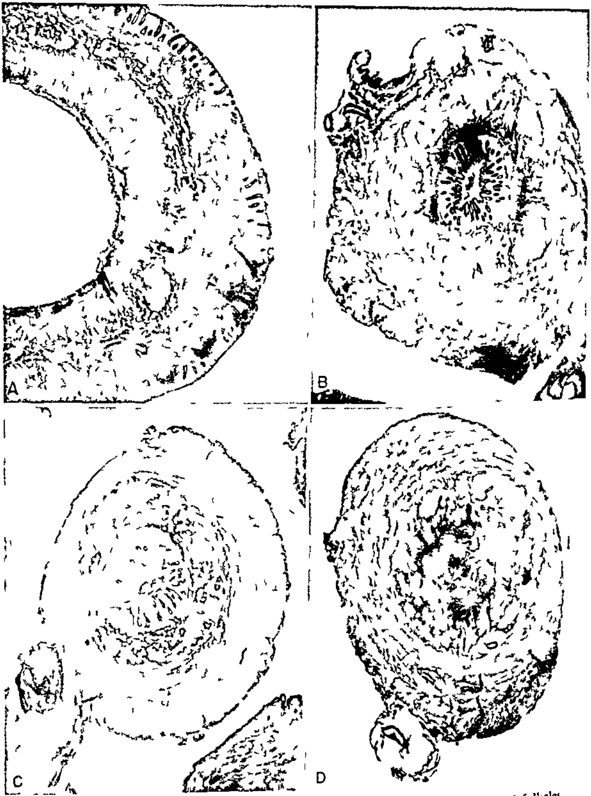


Fig 15 1 *A* Normal appendiceal wall of an adult The mucosa and lymphoid follicles are prominent The muscle layer is thick and well developed *B* *C* *D* Appendixes removed incidentally from patients age 60 70 and 80 The mucosa tends to be thin and the lumen is almost obliterated in *D* The lymphoid elements have disappeared and are replaced by fat which in areas extends throughout the fibrous wall of the organ The vessels in the muscle layers and periappendiceal fat are prominent and thick walled

TABLE 15-4 SYMPTOMS AND SIGNS IN 134 PATIENTS WITH ACUTE APPENDICITIS

Symptoms	*No of patients*	*Signs*	*No of patients*
Abdominal pain	134	Abdominal tenderness	134
First generalized then localized in		RLQ	72
RLQ	74	Generalized tenderness most marked	
RLQ	35	RLQ	46
No localization	24	LLQ tenderness	3
Right lumbar area	1	No localization	13
Nausea	43	Tenderness on digital examination	31
Vomiting	50	Rebound tenderness most marked RLQ	44
Constipation	19	Rigid abdomen	7
Chills	15	Mass palpable	18
Fever	15	Silent abdomen	12
Diarrhea	9	Abdominal distention	27
Anorexia	39	Temperature	
Dysuria and frequency	4	Normal or subnormal	
Distention	8	Peritonitis	7
		No perforation	6
		Temperature over 39 C	
		Peritonitis	26
		No perforation	7

the pain finally localizes in the vast majority it does so much later than in younger persons Over one third of the patients associate their early symptoms with the need for catharsis and this is usually vigorously applied Nausea anorexia and vomiting are found in over half the patients Constipation is common but frequently bowel movements are normal and diarrhea is occasionally seen without cathartics Although pain is almost always present it may be subordinate to other symptoms Not infrequently drowsiness and lassitude with a feeling of abdominal distention may be the first symptoms and if sedatives are being taken the pain may never become evident This picture has been observed not infrequently in patients already hospitalized for other ailments and only a certain degree of awareness and suspicion along with repeated observations and abdominal examinations revealed its true cause

PHYSICAL FINDINGS

The physical findings in appendicitis in old age differ mainly by virtue of the advanced stage of the process when the patient is seen by the surgeons and sometimes by the paucity of findings in the face of severe disease Almost one of every six will have a mass palpable either by abdominal or digital examination (Table 15-4) Tenderness in the right lower quadrant may be elicited in the majority of patients but quite often this is relative as generalized tenderness is present in almost half of the cases Muscular guarding on palpation is not as marked as in younger patients but rebound and referred rebound tenderness are quite valuable in locating the source of trouble Distention of the abdomen is frequently prominent even without perforation When generalized peritonitis has supervened localization of the source of trouble is frequently difficult but in many of these situations the subjective location of the pain will be of value The rectal temperature does not always reflect the severity of the process as subnormal temperature may be encountered in severely ill patients with abscess and generalized peritonitis This is often an ominous sign Relatively mild uncomplicated cases of acute appendicitis may also show high fevers

LABORATORY EXAMINATIONS

Although laboratory procedures do not assist much in diagnosing acute appendicitis, they are often essential to evaluate the functional performance of other vital organs

To assist in the differential diagnosis of other acute intraabdominal conditions, a white blood cell count and stool examination may be helpful There may not be much leukocytosis but almost always there is a marked shift to the younger forms of poly morphonuclear leukocytes in direct propor tion to the severeness of the infectious process The presence of hypochromic anemia and occult blood in the stools should of course, arouse strong suspicion of a perforated carcinoma of the cecum or acute ap pendicitis secondary to tumor obstruction of its lumen

BACTERIOLOGY

The organisms found in the peritoneal cavity of patients with abscesses and peri tonitis from acute appendicitis are usually those which constitute the normal bowel flora *Escherichia coli* however is the most common organism among older patients while streptococci are usually most common among younger persons The high incidence of mixed infection also may be gleaned from Table 15 5 Mixed infections are usually thought to indicate a graver prognosis in peritonitis than those by a single organism

DIFFERENTIAL DIAGNOSIS

Many of the diseases simulating appendi citis in younger persons play a relatively small role over the age of 60 Nonspecific mesenteric adenitis, so frequently encoun tered in children, is hardly ever seen Sal pingitis or pelvic inflammatory disease of females is a great rarity after the menopause On the other hand diseases of other organs increase proportionately with age Twenty to thirty per cent of persons in this age group have gallstones, constipation is common and malignant tumors of the intraabdominal organs and diverticulitis may obscure the picture Some investigators have found that up to half the patients with acute appendici tis in this age group were subjected to sur gery for the wrong diagnosis It may be noted

TABLE 15-5 CULTURE FROM 65 CASES OF PERFORATED APPENDICITIS

Generalized peritonitis	*No of cases*	*Local peritonitis*	*No of cases*
Solitary organism		Solitary organism	
Escherichia coli	3	*Escherichia coli*	10
Streptococcus	1	*Streptococcus*	1
Aerobacter aerogenes	1	*Aerobacter aerogenes*	1
Total cases	5	Total cases	12
Mixed infection		Mixed infection	
E coli	16	*E coli*	25
Streptococcus	15	*Streptococcus*	18
Clostridium	10	*Clostridium*	9
A aerogenes	6	*A aerogenes*	9
Fusiformis	5	*Fusiformis*	4
Other	5	*Pyocyaneus*	3
		Staphylococcus aureus	2
		Enterococcus	3
		Proteus vulgaris	3
		Other	1
Total cases	16	Total cases	29
		No growth	3

TABLE 15-6 ERRORS IN DIAGNOSIS

	No perforation of appendix	General peritonitis	Local peritonitis
Carcinoma of the cecum			5
Intestinal obstruction		2	1
Acute cholecystitis		1	1
General peritonitis (etiology unknown)		2	
Perforated sigmoid		2	
Total	0 (0 %)	7 (23%)	7 (11 6%)

from Table 15 6 that errors in diagnosis were made in over 10 per cent of the author s cases and that these occurred only in patients with perforation As mentioned earlier the most important factors in establishing the correct diagnosis remain a history of pain and findings of tenderness localizing in the right lower quadrant The importance of frequent examination and close observation of every older person suspected of harboring an acute intraabdominal disease cannot be overemphasized as timing is of utmost importance in the treatment of appendicitis Death from appendicitis is associated for the most part only with perforation and in older persons this occurs early and sometimes with minimal symptoms and signs A period of waiting and procrastination therefore is not as harmless as it has appeared to be among youngsters These patients need earlier hospitalization and earlier operation than those in any other group

POSTOPERATIVE COMPLICATIONS AND DEATHS

The deaths from acute appendicitis in the group under discussion occur among patients with localized or generalized peritonitis In the series of patients from The New York Hospital all the deaths were in this category except one *which occurred in* 1936 (Table 15 7) The causes of death however are changing Uncontrolled infection which used to play a major part up to 1940 is now seldom cited as the direct cause of death although it is still the main contributing factor Cardiac diseases and pulmonary embolus are the main direct causes of death at the present The fact should be noted that death rarely occurred among patients who were seriously ill from an associated disease when they were admitted All patients with heart failure or symptomatic heart disease who were treated vigorously before operation survived the intervention although nonfatal postoperative complications were more frequent in this group It may also be noted that the majority of those complications occurred in patients with perforation and peritonitis (Tables 15 8 and 15 9) On the other hand death seemed to occur more frequently among the persons who were considered better risks in view of a lack of symptoms from vital organs The mortality in this series of 134 patients was 9 or 6 7 per cent the causes of death being enumerated in Table 15 7

MANAGEMENT OF THE PATIENT WITH ACUTE APPENDICITIS

The steadily decreasing over all mortality in acute appendicitis may be attributed to the ready availability of antimicrobial agents and to improvement in general pre and postoperative care It should be noted however that the application of one rule of early operation combined with the factors enumerated have not adequately overcome the

TABLE 15-7 DEATHS FROM APPENDICITIS IN PATIENTS OVER 60 *

	Operation	*Diagnosis*	*Time of death, days postop*	*Cause of death*
1932–1937				
F 83 1935	Appendectomy	Acute appendicitis with gangrene	33	Bronchopneumonia bilateral
F 60 1936	Incision and drainage	Generalized peritonitis	3	Generalized peritonitis Atelectasis of lungs
1937–1952				
F 73 1939	Appendectomy with drainage	Generalized peritonitis	2	Peritonitis Bronchopneumonia
F, 63 1940	Appendectomy with drainage	Generalized peritonitis	2	Sudden death with convulsion Autopsy generalized peritonitis
F 81 1940	Appendectomy with drainage	Localized peritonitis	7	Pulmonary embolus
M 63 1941	Appendectomy with drainage	Localized peritonitis	7	Pulmonary embolus
F 67 1945	Appendectomy with drainage		7	Sudden death associated with excruciating precordial pain No cause found at autopsy
M 71 1953	Incision and drainage of appendiceal abscess	Appendiceal abscess	25	Cardiac failure
M 69 1955	Appendectomy with drainage	Appendiceal abscess	19	Acute pancreatitis Nephrosclerosis Uremia

* The New York Hospital–Cornell Medical Center 1932–1957

seriousness of acute appendicitis in the aged as they have in younger patients The reason is that perforation and peritonitis occur earlier in this group and often with minimal prodromata To increase the number of older persons who come to surgery before the appendix perforates the approach has to be changed Observation at home until the typical picture appears is not safe Antimicrobial therapy has no place unless accompanied by surgery, because a large number of these cases are of the obstructive type and not primarily bacterial Once perforation has occurred every older patient should be treated as a potential cardiac case Correction of fluid and electrolyte imbalance has to be managed with caution so as not to overburden the circulatory system Anoxia or hypoxia must be avoided at all costs as any fall in blood pressure may precipitate a coronary thrombosis The McBurney incision is tolerated best by the older patient and should be utilized whenever possible The author believes that intraperitoneal drainage is indicated whenever perforation has occurred as the incidence of prolonged ileus and intra abdominal abscesses appears to be lessened when this is done When drainage is used there is danger of postoperative hernia In this series hernia occurred in 10 patients and became apparent 3 months to 3 years after the operation an incidence of 12.5 per cent

Appendectomy should be performed whenever possible Occasionally in localized abscesses it is impossible to find the organ without risking contamination of the abdominal cavity In these cases simple drainage should be employed and interval appendectomy carried out later Ten of the author's patients underwent simple incision and drainage of appendiceal abscesses Of these 5 had later interval appendectomy and 2 suffered

TABLE 15-8 POSTOPERATIVE NONFATAL COMPLICATIONS

	Local peritonitis	*General peritonitis*	*No perforations*
Ileus	4		
Fecal fistula	3	3	
Wound infection	3	3	1
Intraabdominal abscess	1	1	
Labyrinthitis	1		
Urinary retention	1	1	2
Thrombophlebitis	3		1
Enteritis	1		
Bronchopneumonia		1	
Intestinal obstruction		1	
Coronary occlusion		1	1
Heart failure			1
Postoperative cholecystitis acute			1
No. of complications	17	11	7
No. of patients	60	30	44

TABLE 15-9 ASSOCIATED SYMPTOMATIC DISEASES IN 56 PATIENTS WITH ACUTE APPENDICITIS AND POSTOPERATIVE COMPLICATIONS IN THIS GROUP *

Disease	*No. of patients*	*Complication*
Arteriosclerotic heart disease	24	Acute cholecystitis (1) Labyrinthitis (streptomycin) (1) Thrombophlebitis (1) Bronchopneumonia (1) Ileus (1)
Major pulmonary diseases		
Emphysema	9	
Bronchial asthma	1	
Chronic bronchitis	3	
Generalized arteriosclerosis	8	
Hypertensive cerebrovascular disease	18	Ileus (1) Urinary retention (3) Wound infection (1) Congestive heart failure (1) Congestive heart failure (coronary occlusion) (1)
Diabetes	11	
Cirrhosis of liver	1	
Benign prostatic hypertrophy	9	
Inguinal hernia	4	
Duodenal ulcer	3	Urinary retention (1)
Obesity	5	Wound infection (1)
Cholelithiasis	5	Acute cholecystitis (1)
Rheumatoid arthritis	1	
Chronic gout	1	
Chronic diverticulitis	1	
Hemiplegia †	1	
Kyphoscoliosis	1	

* There were no fatal complications in this group of patients with symptomatic associated diseases

† Cause not certain

from recurrent abscess before this could be carried out Whenever abdominal distention or peritonitis is present in older patients gastrointestinal decompression should be applied Ileus tends to be more severe and more prolonged in these older patients than in others and often may start a vicious cycle of increased intraabdominal pressure, decreased respiratory efforts stasis and anoxia of the tissues, all of which favor vascular thrombosis

SUMMARY

Appendicitis in the aged is particularly dangerous because perforation may occur early and with minimal symptoms, owing to the normal changes of aging in that organ To improve the outlook for these patients the diagnosis of suspected acute intraabdominal conditions should be approached more urgently Since localization occurs late and since time spent in waiting for it may be profitably used in preparing the patient for surgery hospital observation should be called for earlier than in younger persons The postoperative deaths from appendicitis occur in the group with peritonitis and are mainly due to cardiovascular diseases not suspected on admission Accordingly each patient with peritonitis should be treated as a potential candidate for these complications

BIBLIOGRAPHY

Brotherus J V Acute Appendicitis in Old Persons in *Old Age in the Modern World Report of the Third Congress of the Internal Association of Gerontology* London 1954

Cantrell J R and Stafford E J The Diminishing Mortality from Appendicitis Ann Surg 141 749 1955

Department of Health Education and Welfare Vital Statistics of the United States 1955

Gillespie W J and O Reilly C M Acute Appendicitis in the Elderly Male Am Surgeon 22 1186 1956

Ray B A Study of Appendicitis 1500 Cases at The New York Hospital New York M J 38 412 1938

Wolff W I and Hinman R Acute Appendicitis in the Aged Surg Gynec & Obst 94 239 1952

16

Cancer of the Colon and Rectum

William F Nickel

The principles of surgery for cancer of the colon and rectum are identical with those already discussed earlier in this book that is the chronologic age of patients of 60 years or over does not per se indicate a greater operative morbidity or mortality The patient aged 75 may be a young 75 who weathers an operation as well as many others aged 45 On the other hand the greater number of associated conditions and postoperative complications which occur in this age group as a whole justify treating such patients as a special group with special problems not encountered among younger persons

INCIDENCE

The increase in the number of older persons and in the length of life as well as the general increase in the population as a whole are inevitably reflected in the incidence of cancer but as Fig 16 1 shows there appears to be a somewhat greater increase than can be accounted for by these changes alone In 1956 there were 126 000 cancer deaths in the United States among persons 65 years of age and older In this age group cancer was outranked only by heart disease and cerebral hemorrhage as a cause of death and accounted for 15 per cent of the total mortality Furthermore these older persons account for more than half the total number of cancer deaths at all ages combined It is estimated that 365 000 new cases of cancer occur annually in this age group and that approximately one out of every four persons 65 and over will eventually have cancer

Cancer of the colon and rectum ranks high as a major cause of cancer death in this age group being exceeded only by cancer of the respiratory tract and prostate in men and by cancer of the reproductive organs in women (Fig 16 2) Incidence figures parallel mortality figures except that the incidence of skin cancer especially of the face head and neck is very high in the older age groups but deaths from this cause relatively few Deaths from cancer are also somewhat reduced because of the heavy toll taken by cardiovascular renal disease

Table 16-1 illustrates changes in the incidence of cancer of the colon and rectum over a period of 26 years as analyzed from one large series While comparable figures do not seem to be available for longer periods of time earlier studies compared with these figures indicate not only that cancer of the colon and rectum has increased roughly parallel with the general increase in cancer but also that there has been a gradual movement of the heaviest incidence toward the older age groups so that today cancer of the colon and rectum is predominantly a disease of persons 60 years of age or older This movement of incidence toward the older age groups is generally characteristic of cancer but applies more to cancer of some organ systems than of others

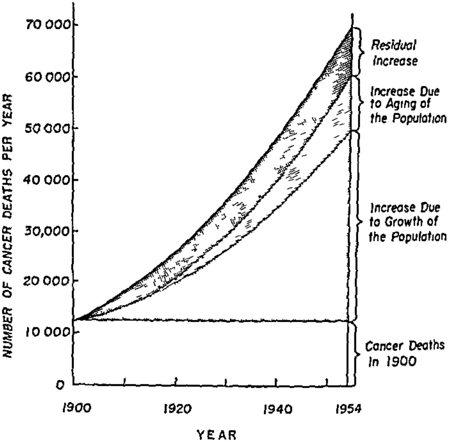


Fig 16 1 Increase in cancer since 1900 (*From Biometry Branch of the National Cancer Institute The Extent of Cancer Illness in the United States*)

DIAGNOSIS

While the actual symptoms of cancer of the colon and rectum do not differ in the older patient from those in the younger and more robust group certain differences in attitude and consequently in history are rather generally recognized Partly because of changing mental faculties in the more advanced years and partly because the older person is assigned a secondary role in our society, the elderly patient may voice his complaints less readily and he may therefore not reach the physician so promptly The effects of this tendency are considered to be partly offset by the apparently slower rate of growth of tumors in the elderly so that the delay in admission for diagnosis and treatment does not greatly affect the survival rate relative to that of younger persons

For example, a 76 year-old man was admitted to The New York Hospital with a diagnosis of cancer of the rectosigmoid Two years before admission roentgenograms taken in the outpatient department had disclosed a filling defect at the precise site of the present tumor there is little question that the cancer was recognized at that time but the patient refused hospitalization He was finally admitted with symptoms of acute obstruction Transverse colostomy was performed and 2 weeks later the sigmoid and adherent small bowel with an enterocolic fistula were resected with end to end anastomosis The patient was alive and apparently free from cancer 5 years later although he had suffered a cerebrovascular accident after 4 years

This case illustrates several points A certain number of elderly patients cling to the belief that the hospital is a place to die and refuse admission, although the diagnosis

and plan of treatment are clearly explained It also illustrates the slow rate of growth of some tumors in the aged If we accept Wangensteen s belief that some tumors of the colon in the aged are present for at least 20 months before they produce symptoms, it is possible that this tumor was present for about 4 years before operation Yet this patient was living apparently well 5 years after discharge

As will be evident later however certain observations made during the study of 471 elderly patients at The New York Hospital–Cornell Medical Center suggest that these general observations on the older patient s attitude may not apply in all cases It seems

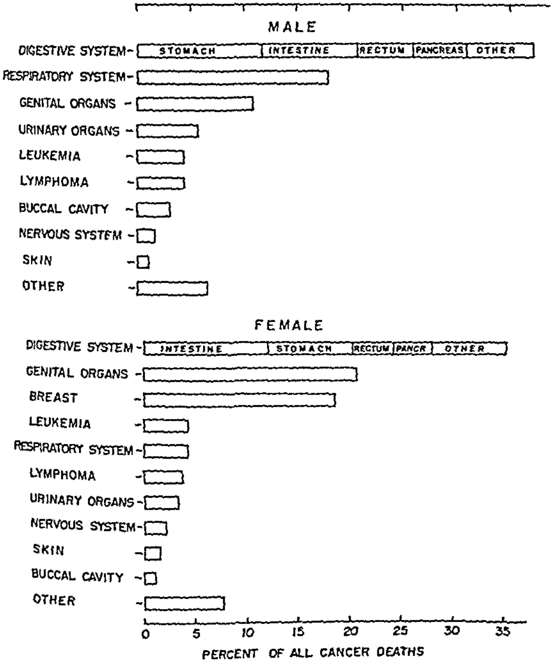


Fig 16-2 The distribution of cancer deaths by site 1954 (*From Biometry Branch of the National Cancer Institute The Extent of Cancer Illness in the United States*)

TABLE 16-1 CHANGES IN INCIDENCE OF CANCER OF THE COLON AND RECTUM *

Date	Age yr					
	To 39	40–49	50–59	60–69	70–79	80 and over
Colon						
1935–1940	20 7	65 8	164 8	371 5	701 0	865 4
M	9 1	24 6	78 7	177 8	330 0	414 8
F	11 6	41 2	86 1	193 7	371 0	450 C
1947–1951	27 6	56 5	200 7	426 4	783 4	1 231 5
M	11 6	22 0	85 7	219 4	386 7	559 0
F	16 0	34 5	115 0	207 0	396 7	672 5
Rectum						
1935–1940	17 5	40 3	136 7	267 6	399 8	480 8
M	9 6	16 7	80 3	170 6	238 9	225 5
F	7 9	23 6	56 4	97 0	160 9	255 3
1947–1951	14 3	49 8	147 2	294 8	385 7	577 0
M	6 7	25 2	81 0	180 0	227 1	315 3
F	7 6	24 6	66 2	114 8	158 6	261 7
Total						
1935–1940	38 2	106 1	301 5	669 1	1 100 8	1 346 2
1947–1951	42 9	166 3	347 9	1 095 4	1 969 1	2 808 5

* Number of cases per 100 000 in the population 1935–1940 to 1947–1951
Adapted from M H Griswold C S Wilder S J Cutler and E S Pollack *Cancer in Connecticut 1935–1951* Connecticut State Department of Health Hartford Conn 1955 Table 4

probable that the older patient s attitude toward his symptoms like his ability to withstand operation cannot always be judged solely on the basis of his chronologic age and that at times other considerations may some what counterbalance a tendency to minimize symptoms

DURATION OF SYMPTOMS

The interval between the first observation of symptoms and admission to the hospital, as reported in several large series varies be tween 7 and 9 months depending on many factors, such as the economic level and in- telligence of the patient and the astuteness of the physician In the series of older pa tients at The New York Hospital the aver age duration of symptoms before admission was 8 months (Table 16 2) or about mid way between the duration for all ages in these other reports Moreover, contrary to what might be expected if age and memory de- fects tend to delay observation of symptoms there was a decrease in the duration of symp toms from the seventh through the ninth decades While various factors may be oper ating, it is possible that as age advances the patients or their families or both find it increasingly difficult to ignore signs of de creasing general health and that as the age at which fatal illness may be expected ap proaches attention to symptoms may a

TABLE 16-2 DURATION OF SYMPTOMS IN 471 ELDERLY PATIENTS WITH CANCER OF THE COLON AND RECTUM *

Age yr	No of patients	Average duration of symptoms months
60–69	290	8 1
70–79	156	7 9
80–89	25	5 3
Total	471	7 0

* The New York Hospital-Cornell Medical Center 1946–1958

times be more rather than less prompt The fact that the duration of symptoms varies considerably among persons in each age group suggests that different attitudes may be operating in different persons

The delay between the onset of symptoms and admission is generally attributed how ever not only to the patient but sometimes also to the physician or to both together There is little doubt that memory defects forgetfulness dulling of sensitivity or less ened awareness of bodily functions on the part of the more elderly or senile patients may account for part of the delay But it is probably equally true that the physician may be held partly responsible It has been re ported for example that approximately half the patients in a series of 100 with cancer of the colon and rectum had been treated for hemorrhoids irritable colon colitis gall bladder disease or appendicitis or had un dergone fulguration for tumor before the primary underlying cancer was recognized

Among the common errors is the assump tion by the physician that such symptoms as rectal pain rectal bleeding constipation or diarrhea or even tenesmus and decreased caliber of the stool are due to local benign conditions at the anal orifice such as hemor rhoids or anal fissure Everyone who has dealt with patients with cancer of the colon or rectum has had the depressing experience of discovering that a patient with obvious cancer has been treated or even operated upon for hemorrhoids without recognition of the cancer Close questioning of some of these unfortunate victims reveals that a few have not even had the benefit of a digital rectal examination On several occasions the patient despite the fact that he has pre viously been seen by several physicians has finally inserted his own finger into his anal orifice and himself discovered the tumor

SYMPTOMS

Bleeding

Among the more common symptoms of cancer of the colon and rectum is rectal bleeding which occurred in 43 per cent of elderly patients in The New York Hospital series (Table 16 3) This is usually slight, the patient describing a little coloring of the water in the toilet bowl or a little bright blood on the toilet tissue Thereafter bleeding is intermittent seldom constant and even less frequently severe or massive If the patient has hemorrhoids as many elderly patients do he may mislead himself into thinking that these are the source of the blood and there fore will not seek medical advice until con siderable time has elapsed Other conditions such as diverticulitis nonspecific inflamma tory disease anal fissure or anal fistula and occasionally severe constipation may be re sponsible for rectal bleeding of this type These possible causes can be disregarded by the physician until a thorough search has been made for an underlying tumor

On only five occasions in the present series was massive melena severe enough to require transfusion and in only one case was it necessary to operate before hemorrhage could be stopped This patient a 77 year-old clergyman entered The New York Hospital in November 1956 after massive bleeding for 8 hours During the next 12 hours 1 500 cc of whole blood was required to maintain his hematocrit near normal levels but the hemorrhage continued He was taken to the operating room anesthetized and placed in the Trendelenburg position Neither sigmoid oscopy nor a Levin tube introduced into the stomach revealed the source of the hemor rhage The peritoneal cavity was then en tered through a long right rectus incision The large bowel contained old blood from the ileocecal valve to the peritoneal reflec tion No tumor mass could be palpated Be ginning in the ascending colon a series of colotomies was made in such a way that the entire colon could be visualized through a sterilized sigmoidoscope The lesion respon sible for the bleeding proved to be an 8 mm sessile slightly raised tumor 30 mm from the anal orifice from the center of the lesion there was constant bleeding The lesion could not be palpated from outside the lumen even

TABLE 16-3 SYMPTOMS IN 471 PATIENTS WITH CANCER OF THE COLON AND RECTUM *

Symptoms	*Age yr*			*Total*	*Per cent*
	60–69	70–79	80–89		
Bleeding	129	61	7	197	43
Massive hemorrhage	4	0	1	5	
Pain	120	63	10	193	41
Weight loss	87	65	4	156	33
Constipation	92	41	10	143	30
Diarrhea	74	39	5	118	23
Tenesmus	30	16	3	49	10
Decreased caliber stool	21	23	2	46	9
Easy fatigue	10	9	0	19	4
Anemia	7	4	1	12	2 5
Obstructive phenomena	43	25	5	73	15
Urgency frequency	9	1	0	10	
Dysuria	6	3	0	9	
Hematuria	2	0	0	2	
Mass felt by patient	3	5	1	9	
Distention felt by patient	4	1	0	5	
Vaginal discharge	0	1	0	1	
Rectal burning	0	1	0	1	
Discovered on routine examination no symptoms	18	12	4	34	

* The New York Hospital–Cornell Medical Center 1946–1958

after its exact location had been determined Since the patient had advanced inoperable buccal cancer the colonic lesion was locally excised and hemostasis was established Examination of the frozen section made at the time of operation gave only equivocal information but the pathologist s report after study of the permanent sections stated the cells lining the glands at the tip of the small papillary lesion are sufficiently anaplastic to be characterized as carcinoma However it was so limited to the end of the tiny papilloma that it is almost certain that the entire lesion has been eradicated No further hemorrhage occurred and the patient died two years later of coronary occlusion after having undergone a palliative operation for his buccal cancer and having in the meantime enjoyed an active career as editor of a national religious publication

Pain

Some type of pain was a symptom of cancer in 41 per cent of The New York Hospital series of elderly patients Pain may occur without regard to the location of the lesion and depends largely on the size of the tumor and the degree of obstruction which it produces There is nothing specific in the character of pain associated with cancer of the colon and rectum It may vary from a feeling of fullness to the cramplike colicky pain of an obstructive lesion Unless the lesion has extended to involve the nerve roots in the pelvis constant gnawing pain is rare When such pain is present it indicates a poor prognosis Pain may also be burning drawing or sharp and knifelike it is frequently relieved by bowel movement In cases of cancer of the colon and rectum, therefore, pain serves only to alert the physician to the need for careful investigation

Constipation and Diarrhea

Of far greater importance is the presence of either constipation or diarrhea or both which were present in 55 per cent of this series Constipation alternating with diarrhea

is frequent Tumors which produce partial obstruction of the colon or rectum are re sponsible for the diarrhea the obstruction exerting a ball valve effect which causes liquefaction of fecal matter proximal to the lesion This phenomenon is more likely to appear when the tumor is in the descending colon and rectum but may be associated with cancer anywhere in the large intestine Therefore a history of diarrhea must be regarded as a highly suspicious sign and the patient should be carefully examined even though he is apparently suffering only from colitis food poisoning gastroenteritis gallbladder disease or some other nonmalignant con dition

Obstruction

Approximately 14 per cent of the elderly patients in the present group reported that their initial symptoms were those of obstruc tion cramplike pain increased constipation or frank obstipation distention nausea and vomiting The mortality rate in this group was 15 per cent (10 patients) There were also 10 cases of perforation of the colon and rectum in this group and 5 of the 10 died accounting for 50 per cent of the 10 post operative deaths (Table 16 4)

Comparison of two reports indicates that there is little difference in the incidence of obstruction in the older and younger age groups Goligher and Smiddy reported that 290 (17 6 per cent) in a series of 1 644 patients of all ages seen over a period of 15 years were admitted with obstruction as the first manifestation of cancer of the colon or rectum mortality in this series was 34 per cent Wantz and Glenn reported a series of 120 patients 65 years of age and over ad mitted to The New York Hospital between 1944 and 1954 with acute intestinal obstruc- tion Nineteen of these patients (15 per cent) had cancer of the colon 16 in the left and 3 in the right colon Six of these patients (31 5 per cent) died In 5 instances the ob struction was in the left colon but 3 of these were cases of carcinomatosis

Obstruction is most frequently associated with lesions of the descending colon and sigmoid but also occurs with great frequency in cases of cancer of the ascending and trans verse colon It is least likely to occur in the rectal ampulla and cecum since in these sites the bowel is more distensible than elsewhere and other symptoms are likely to appear be fore the obstruction develops

Tenesmus and Decreased Caliber of the Stool

Tenesmus decreased caliber of the stool or both are most frequently associated with

TABLE 16-4 ACUTE INTESTINAL OBSTRUCTION IN CANCER OF THE COLON AND RECTUM IN ELDERLY PATIENTS *

Age yr	No of cases	Location			Operation				Perfo- ration	Mortal ity	Follow-up mo (av)
		L colon and rectum	Trans verse colon	R colon	Trans verse colos tomy	Ileo- colos tomy only	Pri mary resec tion	Other			
60-69	35	2	3	5	21	1	-	6	3	5	31
70-79	24	20	1	3	1[illegible]	1	4		6	4	11
80-89	6	3		3	2	2	1	1	1	1	13
Total	[illegible] (14 %)	[illegible]0	4	11	42	4	12	-	10	10 (15%)	

* The New York Hospital Cornell Medical Center 1[illegible] 1[illegible] 8

lesions of the *rectum or sigmoid and indicate* that the lesion is large enough to encroach upon the lumen, producing localized obstruction which is not necessarily accompanied by *cramps nausea vomiting or distention* These symptoms may be present for long periods before the tumor is discovered

Weight Loss

An unaccountable weight loss is one of the commonest complaints in elderly patients with cancer of the colon or rectum and was present in 33 per cent of The New York Hospital series Frequent accompanying symptoms are anorexia easy fatigue anemia and weakness These symptoms are most often associated with lesions in the right colon while those in the left are more prone to produce symptoms of obstruction However none of these symptoms is specific to lesions of either right or left but may be associated with tumors anywhere in the colon or rectum

Symptoms of Urinary Tract Disturbance

Symptoms of cancer of the colon or rectum in elderly patients may be chiefly or *completely confined* to the urinary tract This occurred in 10 cases in the present series In such instances the urologist is responsible for making the proper differential diagnosis and for working with the surgeon in managing the patient Usually urologic symptoms mean that cancer of the rectum or sigmoid has remained undetected for a long period and has spread to involve the lower urinary tract producing urinary symptoms too severe to be ignored by even the most senile

METHODS OF DIAGNOSIS

At least one third of all cancers of the colon can be palpated through the abdominal wall or rectum during physical examination Digital examination of the rectum should be *part of every routine physical examination* No other bodily orifice lends itself more readily and safely to examination than the anal orifice so that there is no practical reason *for omitting this essential procedure* (Table 16 5 and Fig 16 3)

It has been found that at least two thirds of all tumors of the colon or rectum are within reach of the sigmoidoscope These observations emphasize the importance of supplementing the physical and rectal examination with sigmoidoscopy, which can be carried out with a minimum of equipment in only a few extra minutes of the physician s time

TABLE 16-5 DISTRIBUTION OF LESIONS IN 471 ELDERLY PATIENTS WITH CANCER OF THE COLON AND RECTUM *

Location of lesion	*Age yr*				
	60–69	70–79	80–89	*Total*	*Per cent*
Cecum	13	11	3	27	6
Ascending colon	36	21	3	60	12
Transverse colon	13	10	1	24	5
Descending colon	9	4	0	13	3
Sigmoid (above peritoneal reflection)	88	41	7	136	29
Rectum (below peritoneal reflection)	131	68	10	209	44
Anus	0	1	1	2	
Total	*290*	*156*	*25*	*471*	100

* Admitted to The New York Hospital-Cornell Medical Center 1940–1958

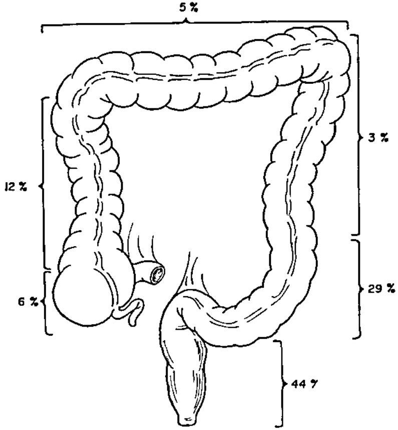


Fig 16 3 Distribution of cancer of the colon and rectum in 471 elderly patients The New York Hospital 1946–1958

This examination should in turn be supplemented by roentgenograms with a barium enema regardless of the observations made with the sigmoidoscope If the sigmoidoscopic examination does not disclose a tumor the barium enema may do so If sigmoidoscopy does reveal a lesion the barium enema study should be carried out regardless since the multicentric origin of colonic cancer in some persons has been well established Bacon s tabulation of the observations of 10 authors showed that multiple primary lesions of the colon and rectum occur in 1 to 8 per cent of patients (See Table 16 6)

It should also be pointed out that a negative result from the barium enema study following negative sigmoidoscopy does not necessarily rule out tumors of the colon or rectum There are certain blind spots which are difficult to visualize by fluoroscopy or roentgenograms These include the distal rectal ampulla splenic flexure hepatic flexure and the region of the ileocecal valve The physician should be certain from personal examination of the films and consultation with the roentgenologist that the examination has been satisfactory before ruling out tumors of the colon and rectum as the origin of the patient s complaints

One additional method of diagnosis is cytologic examination according to the method of Papanicolaou Based on the fact that malignant neoplasms constantly exfoliate their superficial cells washings from the left colon are collected in 95 per cent alcohol centrifuged smeared and stained This method is especially useful in detecting lesions of the left colon which are beyond reach of the

TABLE 16-6 MULTIPLE LESIONS IN ELDERLY PATIENTS WITH CANCER OF THE COLON AND RECTUM *

Location	*Age yr*			
	60–69	70–79	80–89	*Total*
Primary lesions in colon and rectum				
2 in descending colon	1	0	0	1
2 in ascending colon	1	0	0	1
2 in right colon 1 in sigmoid	0	1	0	1
2 in sigmoid	2	1	0	3
Colon and rectum	4	0	0	4
Colon and sigmoid	0	0	1	1
Sigmoid and rectum	2	1	0	3
Sigmoid and cecum	0	1	0	1
Total	10	4	1	15 (3 4%)
Primary lesions in other organ systems				
Buccal mucosa	1	2	0	3
Face	0	0	1	1
Cervix	1	0	0	1
Breast	1	0	0	1
Prostate	1	0	0	1
Bladder and prostate	1	0	0	1
Total	5	2	1	8 (1 7%)
Total with multiple lesions	15	6	2	23 (5 1%)

* The New York Hospital–Cornell Medical Center 1946–1958

sigmoidoscope and in cases with doubtful differential diagnosis between diverticulitis and cancer of the colon In a series of 200 examinations made by this method, there were no known false positive diagnoses of 19 cases proved by operation to be cancer 18 had positive or equivocal smears These experiences seem to indicate that cytologic examination is a reliable adjunct to the rou tine methods of detecting carcinoma of the colon and rectum

DIFFERENTIAL DIAGNOSIS

Differential diagnosis depends on the ex clusion of other diseases Any and all symp toms even remotely associated with the lower gastrointestinal tract should be considered as possibly cancer until cancer has been defi nitely excluded Several diseases, however deserve special emphasis in discussing differ ential diagnosis in the older age groups

First and foremost is diverticulitis of the sigmoid which may produce the same symp toms or roentgenographic picture as cancer and may even appear as a palpable mass It may be impossible to differentiate this lesion from cancer without resection and examina tion of the pathologic specimen Since diver ticulosis increases with age through the sev enth and eighth decades it can be easily appreciated that diverticulitis will increas ingly tax the physician s diagnostic ability

Chronic ulcerative colitis may occasionally simulate cancer of the colon and rectum but its highest incident is in the third and fourth decades and it is uncommon in persons over 60 When the problem does arise, however it is doubly disturbing since the symptoms may be identical with those of cancer and since

the incidence of cancer increases among patients with ulcerative colitis in all age groups

Tumors of the upper gastrointestinal tract may produce symptoms similar or identical to those of cancer of the colon or rectum For example a 75 year-old retired teacher was admitted with complaints of tarry stools loss of weight and loss of energy He had been constipated for many years but recently had become more so A barium enema revealed a defect at the ileocecal valve thought to be carcinoma The upper gastrointestinal series was not performed because of the unfounded fear that the barium meal might precipitate acute intestinal obstruction At operation the apparent defect proved to be due to the ileocecal valve itself which is sometimes mistaken for tumor and a large ulcer crater discovered in the stomach accounted for the patient s symptoms

ASSOCIATED CONDITIONS

Many more associated conditions are present in the older than in the younger age groups Table 16 7 lists the associated conditions noted on the discharge charts of 471 elderly patients with cancer of the colon and rectum in The New York Hospital–Cornell Medical Center series As might be expected by far the greater number (97 or approximately half these associated conditions) involved the cardiovascular system Second only to these were diseases of the genitourinary system which were present in 42 cases Although diverticulosis of the colon is common in patients over 60 years of age complications of this condition were noted in only 15 patients considerably fewer than might have been expected Among the miscellaneous conditions not listed in the table were such diverse diseases as hiatus or inguinal or femoral hernia nodular goiter leukemia lues Parkinson s disease tic douloureux tumor of the rib myofibroma and anal cyst The great variety and number of associated conditions testify to the need for careful evaluation and precise operative preparation which are a *sine qua non* of any therapy of the aged

THERAPY

Perhaps in no other area must the surgeon be so versatile as when treating the aged for carcinoma of the colon and rectum The number and variety of operative procedures employed is so extensive that the only limit is that set by the surgeon s judgment and ability as opposed to rashness (see Table 16 8) Because of technical advances the surgeon can carry out operations of almost unlimited magnitude even in elderly patients How is he to decide what limitations to set in the treatment of the aged? Should the 80-year-old patient be denied the benefit of surgical therapy simply because his expectation of life is relatively short? What is the life expectancy of an 80 year old patient?

Beginning with the last question, it is not possible with the data available today to predict the life expectancy of a person who has attained his eightieth birthday Life expectancy charts prepared by the Metropolitan Life Insurance Company do not predict probably life expectancy beyond the seventieth year In 1956 life expectancy at age 69 was approximately 11 years for white men and 13 years for white women The physician must therefore consider that the 80-year old patient s life expectancy depends upon his physical and mental condition and on the number and kind of associated conditions He has to assume that the patient who has attained his eightieth birthday in reasonably good health will probably continue to live for a reasonable period providing the neoplasm of the colon or rectum is removed However before deciding on the technical methods to be used the surgeon has to consider a number of factors which do not ordinarily apply among younger patients

Polyps of the Colon and Rectum

When a polyp of the colon is discovered above the reach of the sigmoidoscope it has

TABLE 16-7 ASSOCIATED CONDITIONS IN ELDERLY PATIENTS WITH CANCER OF THE COLON AND RECTUM *

Condition	*Age yr*			
	60–69	70–79	80–89	*Total*
Cardiovascular system				
Arteriosclerotic heart disease	14	15	13	42
Hypertensive cardiovascular disease	14	11	7	32
Bundle-branch block	1	3	1	5
Rheumatic heart disease	2	0	0	2
Aortic stenosis	0	1	0	1
Auricular fibrillation	1	1	0	2
Coronary thrombosis	1	0	0	1
Myocardial infarction	0	1	0	1
Arteriosclerosis generalized	3	3	1	7
Aneurysm abdominal aorta	1	1	0	2
Cardiovascular accident	1	1	0	2
Genitourinary system				
Chronic pyelonephritis	2	1	0	3
Renal calculus	1	0	0	1
Urethral stricture	1	0	1	2
Benign prostatic hypertrophy	13	17	4	34
Leukoplakia bladder	1	0	0	1
Cystitis	0	1	0	1
Gallbladder disease				
Cholelithiasis	7	4	0	11
Acute cholecystitis	2	0	0	2
Liver disease				
Cirrhosis of the liver	1	2	0	3
Esophageal varices	1	0	0	1
Jaundice cirrhosis and esophageal varices	1	0	0	1
Gastrointestinal disease				
Diabetes	1	2	0	3
Gastric ulcer	1	2	0	3
Duodenal ulcer	0	2	0	2
Marginal ulcer	0	1	0	1
Diverticulosis	8	4	3	15
Chronic ulcerative colitis	0	1	0	1
Miscellaneous				
Senility	0	3	1	4
Phlebitis	0	1	0	1
Other	7	7	1	15
Total	85	85	32	202

* The New York Hospital–Cornell Medical Center 1946–1958

been the policy in The New York Hospital–Cornell Medical Center to remove the lesion by the transperitoneal route and if either the immediate frozen or the delayed permanent section shows cancer, to resect the bowel A more conservative approach is however adopted when an aged patient has serious cardiovascular or upper urinary tract lesions the presence of the polyp is not the sole criterion determining the desirability of an operation Furthermore if a polyp is removed and appears benign grossly and in frozen section but malignant in the delayed permanent preparation the author has in a number of instances decided not to reoperate This dilemma is most pronounced when the polyp occurs in the lower rectum and the only possible operation is the Miles abdom-

inoperineal resection This problem arose in nine patients in the present series In six instances no operation was performed These six patients have been followed from 2 to 10 years with no evidence of recurrent cancer of the intestinal tract though one died at the end of 2 years from metastatic cancer of the breast The Miles abdominoperineal resection was performed in three other patients after the polyp had been removed They have been followed for 4 to 7 years without evidence of recurrence Recent studies by Moyer and Enquist seem to throw further doubt on the already moot question as to the necessity of performing radical operation for single isolated polyps of the rectum or colon in any age group

Cancer of the Rectum

When an elderly patient has definitely proved cancer of the rectum the surgeon has certain alternatives to the standard Miles abdominoperineal resection He may perform an anterior resection with end to-end anastomosis below the peritoneal reflection or the abdominoperineal pull through procedure with preservation of the sphincter as advocated by Bacon Chenowith and others Rarely if the patient is extremely debilitated a simple perineal pull through operation can be done without entering the peritoneal cavity from above

It is generally agreed that all cancerous lesions less than 5 cm from the anorectal line should be removed by the Miles procedure unless distant metastases or serious associated conditions make this operation rash There is no agreement however as to the proper employment of anterior resection of the rectum except that none would question its value as a palliative procedure or that its greatest usefulness is for palliation For this reason anterior resection is especially useful in treating aged patients who have obvious distant metastases and who because of debility cannot manage a colostomy and have no relatives or friends to manage it for them The same reasoning applies to the selection of a perineal pull through operation whether of the combined abdominoperineal or of the simpler perineal type It is questionable whether the Miles abdominoperineal resection should ever be employed as a palliative operation

Table 16 9 shows the difference between the mortality following the Miles procedure

TABLE 16-8 TYPE OF OPERATION IN ELDERLY PATIENTS WITH CANCER OF THE COLON AND RECTUM *

Operation	Age yr			
	60–69	70–79	80–89	Total
Miles abdominoperineal resection	86	47	5	138
Resection of left colon end to-end anastomosis	99	49	5	153
Resection of right colon ileocolostomy	43	27	4	74
Anterior resection of rectum	16	6	2	24
Colostomy only	21	16	4	41
Perineal pull through	7	3	1	11
Local excision of malignant polyp	3	3	0	6
Exploratory laparotomy only	5	2	0	7
Ileocolostomy only	4	2	1	7
Pelvic exenteration	5	0	0	5
Mikulicz s operation	1	0	0	1
No operation	0	1	3	4
2 or more operations on same patient	4	2	1	7
Total	294	158	26	478

* The New York Hospital-Cornell Medical Center 1946–1958

TABLE 16-9 MORTALITY FOLLOWING MILES ABDOMINOPERINEAL RESECTION ANTERIOR RESECTION OF THE RECTUM AND PERINEAL PULL-THROUGH *

Age yr	*No of cases*	*No of deaths*	*Mortality %*
Miles abdominoperineal resection			
60–69	86	7	8 1
70–79	47	1	2 1
80–89	5	0	0 0
Total	138	8	5 8
Anterior resection of the rectum			
60–69	16	1	6 3
70–79	6	0	0 0
80–89	2	0	0 0
Total	24	1	4 2
Perineal pull through			
60–69	7	0	0 0
70–79	3	0	0 0
80–89	1	0	0 0
Total	11	0	0 0

* The New York Hospital-Cornell Medical Center 1946–1958

anterior resection and perineal pull through operation In interpreting these tables it should be remembered that anterior resection and perineal pull through were used on the more debilitated patients while the Miles procedure was employed as a curative operation It is also noteworthy that of the eight patients over the age of 80 none died during the postoperative period and five withstood abdominoperineal resection This experience shows as pointed out by Buckwalter Cattell, and others that aged patients tolerate curative operations well when they are carefully selected and prepared

Survival rates following Miles abdominoperineal resection anterior resection of the rectum and perineal pull through operations on elderly patients at The New York Hospital are given in Tables 16 10 16 11 and 16 12 It is of special interest that the 5 year survival rates following anterior resection and the perineal pull through procedure are better than those following the Miles abdominoperineal resection However the figures are too few to be statistically significant

Cancer of the Colon Distal to the Hepatic Flexure

Cancer of the colon above the peritoneal reflection presents no particular problem in the aged It has been the author s policy to perform a simple wedge shaped resection with end to end anastomosis whenever feasible The extent of the operation and the amount of tissue removed depend entirely on the surgeon s appraisal of the problem with which he is dealing His decision is based on such factors as the general condition of the patient the size and extent of the lesion and the presence or absence of distant metastases The surgeon s attitude toward the cancer problem in general and his technical ability also influence the extent of his procedures The author does not criticize Wangensteen or any of the others who advocate the more radical and extensive operations such as total or subtotal colectomy for all cases of colon cancer beyond the hepatic flexure However the author has developed a technique which he believes serves the aged patient well It is less traumatic than the more radical and time consuming procedures and therefore causes less morbidity in this group

The technique consists first in careful preparation of the intestinal tract by mechanical cleansing of all fecal matter The patient is placed on a clear liquid diet and for 3 days is given a series of gentle purges combined with cleansing enemas Sterilization or near sterilization is obtained by means of oral antibiotics such as neomycin or the much less expensive sulfonamide derivatives which are not absorbed from the intestines The patient s diet is supplemented by vitamins intravenous fluids and blood if necessary Any electrolyte imbalance is carefully and precisely corrected defects in the cardiovascular or renal system are supported as far as possible and every effort is made to insure adequate preparation of the patient

TABLE 16-10 SURVIVAL RATES MILES ABDOMINOPERINEAL RESECTION OF THE RECTUM *

Age yr	No of cases	No living without cancer	No living with cancer	Total living
		3 yr survival rates operation 1946–1955		
60–69	[illegible]	36 (52.2%)	12 (17.4%)	48 (68.7%)
70–79	45	21 (46.6%)	8 (17.7%)	29 (64.4%)
80–89	3	0	1 (33.3%)	1 (33.3%)
Total	117	57 (48.6%)	21 (17.9%)	78 (66.7%)
		5-yr survival rates operation 1946–1953		
60–69	58	26 (44.8%)	5 (8.6%)	31 (53.5%)
70–79	42	17 (35.7%)	1 (2.4%)	18 (42.9%)
80–89	0	0	0	0
Total	100	43 (43.0%)	6 (6.0%)	49 ([illegible])

* The New York Hospital–Cornell Medical Center

At operation the lesion and its gross extensions are assessed by gentle palpation and inspection If the condition appears amenable to cure a wedge shaped resection is then performed A rent is first made in the mesentery far enough above and below the tumor that the primary lesion is encompassed by a wide margin of normal bowel but not so far that an end to end anastomosis cannot be completed without tension The lumen of the bowel is then occluded at these points with heavy nylon or silk ligatures The next step consists in ligating the main blood supply of the area to be resected The last two steps prevent exfoliated cancer cells from being disseminated either into the lumen of the bowel above or below the tumor or into the blood stream during subsequent manipulations

The wedge shaped section of the mesentery is then resected In performing the anastomosis the posterior row of interrupted sutures is placed The resection clamps are then removed and the open proximal and distal ends of the colon are carefully inspected for vascularity and other lesions

TABLE 16-11 SURVIVAL RATES ANTERIOR RESECTION OF THE RECTUM *

Age yr	No of cases	No living without cancer	No living with cancer	Total living
		3-yr survival rates operation 1946–1955		
60–69	14	8 (57.3%)	0	8 (57.3%)
70–79	3	2 (66.6%)	0	2 (66.6%)
80–89	1	0	0	0
Total	18	10 (55.5%)	0	10 (55.5%)
		5-yr survival rates operation 1946–1954		
60–69	10	6 (60.0%)	0	6 (60.0%)
70–79	2	1 (50.0%)	0	1 (50.0%)
80–89	0	0	0	0
Total	12	7 (58.3%)	0	7 (58.3%)

* The New York Hospital–Cornell Medical Center

TABLE 16-12 SURVIVAL RATES PERINEAL PULL-THROUGH FOR CANCER OF THE RECTUM *

Age yr	*No of cases*	*No living without cancer*	*No living with cancer*	*Total living*
	3 yr survival rates operation 1946-1955			
60-69	7	6 (85 6%)	0	6 (85 6%)
70-79	2	2 (100%)	0	2 (100%)
80-89	1	1 (100%)	0	1 (100%)
Total	10	9 (90 9%)	0	9 (90 0%)
	5-yr survival rates operation 1946-1953			
60-69	7	5 (71 4%)	0	5 (71 4%)
70-79	2	2 (100%)	0	2 (100%)
80-89	1	1 (100%)	0	1 (100%)
Total	10	8 (80 0%)	0	8 (80 0%)

* The New York Hospital-Cornell Medical Center

This careful examination is supplemented by introducing a sigmoidoscope into both the proximal and distal loops so that the entire *left colon can be inspected for associated* polyps or multicentric lesions The entire transverse and right colon can be inspected *simply by making such colotomies as may* be necessary for visualizing the entire colon If other lesions are discovered then of *course a subtotal or total resection can be* carried out This method obviates the necessity of performing total colectomy in order *to be certain of removing undiscovered le*sions

In The New York Hospital series unsuspected polyps were discovered either in the resected or the remaining colon in 16 6 per cent of cases and multicentric lesions in 3 4 per cent (see Table 16 13) This point is emphasized by a brief summary from a patient s history A 67 year old man father of *a physician was admitted to the hospital* because of rectal bleeding and a rectal polyp discovered by sigmoidoscopy The barium *enema also suggested that a second polyp* might be present in the hepatic flexure The rectal polyp was readily excised with a snare *and cautery through the sigmoidoscope* and was found to be benign Because of the suspected second lesion exploratory laparotomy was carried out At operation the bowel was carefully palpated and inspected through a long rectus retracting incision *A series of* colotomies was then performed and the lumen of the entire bowel carefully inspected *No lesion could be found in the right half* of the colon or in the hepatic flexure as had been suggested by the barium enema study but in the proximal transverse colon was seen a 2 5 cm slightly raised plaque which *could not be palpated through the bowel* wall, even though its exact location was known A simple wedge shaped resection was performed *with end to end anastomo*sis

TABLE 16-13 UNSUSPECTED POLYPS AND MULTICENTRIC LESIONS IN ELDERLY PATIENTS WITH CANCER OF THE COLON AND RECTUM *

Age yr	*No of patients*	*Unsuspected polyps*	*Multicentric cancers*
60-69	290	41	11
70-79	156	30	4
80-89	25	5	1
Total	471	76 (16 6%)	16 (3 4%)

* The New York Hospital-Cornell Medical Center 1946-1958

Cancer of the Right Colon and Hepatic Flexure

Cancer in the right colon and hepatic flexure has been treated at The New York Hospital by standard resection of the entire right colon and hepatic flexure with end to-end ileotransverse colostomy This operation is widely accepted as the standard procedure for all lesions in this region and mortality is acceptably low (see Table 16 14)

Although the 7 8 per cent mortality in this group is higher than in the series as a whole (6 8 per cent) it should be noted that four of the six deaths occurred in patients who had perforations of the cecum due to ob structing lesions and a fifth patient died fol lowing leakage of the anastomotic line after palliative resection Thus only one death (2 6 per cent) occurred among the 38 pa tients who had curative operations This pa tient developed an acute staphylococcal en terocolitis following intensive antibiotic ther apy The group also included 7 patients who were deemed too ill for even palliative resec tion and therefore had only ileotransverse colostomy

Cancer of the Transverse Colon

Cancer of the transverse colon likewise presents little difficulty in treatment in aged patients The author has employed the standard wedge shaped resection with end to-end anastomosis whenever possible When the lesion is in the splenic flexure it may be difficult to mobilize the intestine but it should be possible to mobilize enough so that an end to end anastomosis can be per formed

TABLE 16-14 MORTALITY FOLLOWING RESECTION OF THE RIGHT COLON WITH ILEOTRANSVERSE COLOSTOMY IN ELDERLY PATIENTS

Age yr	*Resection for cure*	*Resection for palliation*	*Hospital deaths*
60–69	24	23	3
70–79	14	15	2
80–89	0	5	1
Total	38	43	6 (7 8%)

The New York Hospital–Cornell Medical Center 1946–1958

PALLIATION

To palliate means to lessen pain or to alleviate symptoms but not to cure When extensive or distant metastases are present it is not likely that removal of the primary lesion in the colon or rectum will effect a cure Therefore under such circumstances only palliative measures designed to lessen pain or alleviate symptoms are useful

Perhaps the most important form of pal liation is the constant and sympathetic atten tion of those trained to deal with patients who are dying of incurable cancer To these patients the surgeon assumes a role of great est importance Therefore whenever possi ble one should continue to administer to the patient as long as he lives if only as a daily visitor The judicious use of drugs is often the only treatment that is necessary in cases of advanced carcinomatosis

Injudicious use of various operative pro- cedures is often harmful and nothing is more offensive or complicates the care of the patient more than an unwise colostomy It is to be avoided for example as treatment of paralytic ileus which often accompanies carcinomatosis and is mistaken too fre quently for obstruction Likewise colostomy performed in anticipation of possible ob struction is to be condemned for no surgeon can predict accurately when obstruction may ensue any more than he can predict how long a patient with incurable cancer may live Moreover the unwise use of colostomy has given the layman a totally inaccurate impression of its proper use and this ac counts for the horror with which some per sons anticipate the procedure when it is actually necessary

The mortality rate as shown in Table 16 15 indicates the surgical hazards associ ated with terminal colostomy in the aged

TABLE 16-15 MORTALITY FOLLOWING TERMINAL COLOSTOMY ONLY, FOR CANCER OF THE RECTUM IN ELDERLY PATIENTS *

Age yr	*No of cases*	*No of deaths*	*Mortality %*
60–69	15	2	13 3
70–79	10	4	10 0
80–89	0	0	0
Total	25	6	24 0

* The New York Hospital–Cornell Medical Center 1946–1958

The death rate is high, even though the author s policy is to avoid the operation for pseudoobstruction due to abdominal carcinomatosis and even though it is not used in anticipation of obstruction However when the patient has symptoms of obstruction before operation, the author does not hesitate to employ transverse colostomy as the first step in a three stage operation to be followed by resection of the lesion and later by closure of the colostomy Also ileocolostomy is sometimes used alone to relieve obstruction in cases of inoperable cancer of the right colon This procedure can be carried out with little additional hazard to the patient is inoffensive and relieves the obstruction

The place of pelvic exenteration as treatment of cancer of the rectum in the aged can be determined only in the future To date the author has employed this operation only as a superradical procedure for cure in good risk patients in the seventh decade but not in older ones It would seem rash indeed to perform pelvic exenteration as a palliative procedure in debilitated persons whose expectation of life would not be long even without the cancer Credit should however be given to Brunschwig for calling attention to the fact that many recurrent cancers of the rectum grow slowly and can be contained for long periods by superradical operations

Whenever feasible primary lesions of the colon and rectum should be resected with restoration of continuity and of the normal physiology of the intestinal tract It seems clear that distal metastases are sometimes arrested for long periods of time after removal of the primary growth This is particularly true when the primary tumor seems to have metastasized directly to the liver without involving lymph nodes

The mere fact that cancer seems inoperable to the surgeon should not deter him from offering palliative surgery to the patient Some clinicians are blinded by the traditional concept that the length of time that a lesion has been present is the controlling factor in deciding the treatment for cancer, actually some elderly patients with slow growing, apparently advanced lesions of the colon and rectum are amenable not only to palliative procedures but even to curative operations All but the most senile and those with decompensated disease should have the benefit of surgical intervention

Finally the surgeon is under no obligation to prolong suffering merely to prolong life If the contemplated operation will not succeed in alleviating pain or allaying symptoms it has no place in the therapy of these unfortunate victims Of far greater importance to the patient s morale is the knowledge that the surgeon is in constant attendance and ever ready to assume his responsibility should occasion arise

RESULTS

Mortality

Table 16 16 demonstrates the over all hospital mortality in the group of The New York Hospital elderly patients with cancer of the colon and rectum As might be expected the highest mortality was among the oldest patients, but as has already been pointed out those in the ninth decade withstand radical operations surprisingly well (Table 16 9) Of even greater importance perhaps is the fact that 47 patients in the eighth decade successfully underwent Miles abdominoperineal resection with only one death This 79 year old woman had had an

TABLE 16-16 MORTALITY IN ELDERLY PATIENTS WITH CANCER OF THE COLON AND RECTUM *

Age yr	No of cases	No of deaths	Mortality %
60-69	290	16	5.5
70-79	156	10	6.4
80-89	25	6	24.0
Total	471	32	6.8

* The New York Hospital Cornell Medical Center 1946-1958

anterior resection of the rectum 9 months earlier and the Miles operation was performed for recurrence She died during the first few days after operation of a cerebrovascular accident

Complications

As might be expected there were a large number of complications following operations in this age group However the t number, 117 (Table 16 17) among 471 tients compares favorably with the i dence of 82 complications in 165 abdomi perineal resections reported by Waugh M ler and Kurzweg In The New York Ho tal series of 138 aged patients treated by classical Miles abdominoperineal resecti there were 28 complications (Table 16-1

The largest number in the entire gr were the 29 (24 7 per cent of all compl tions) cardiovascular respiratory compl tions A surprising number of complicatic 27 (23 0 per cent) were in the intesti tract and were due either to the operat itself or to underlying conditions which came active during the postoperative peri

Survival Rates

The survival rates of The New York H pital group of elderly patients with cance the colon and rectum are shown in Ta

TABLE 16-17 COMPLICATIONS FOLLOWING OPERATION IN ELDERLY PATIENTS WITH CANCER OF THE COLON AND RECTUM *

Complication	Age yr			Total
	60-69	70-79	80-89	
Cardiovascular respiratory	16	10	3	29 (24.7%)
Phlebitis	7	4	0	11
Genitourinary	6	6	1	13 (11.1%)
Gastrointestinal				27 (23.0%)
Ileus	2	1	0	3
Obstruction	5	2	2	9
Intraabdominal abscess	4	0	0	4
Leakage at anastomosis	1	2	0	3
Perforation of hollow viscus	2	1	0	3
Staphylococcus enteritis	1	0	0	1
Stricture of colostomy	0	1	0	1
Duodenal fistula	0	1	0	1
Diverticulitis and perforation	0	2	0	2
Acute cholecystitis	4	2	0	6
Wound infection	3	2	0	5
Wound disruption	1	3	0	4
Homologous serum jaundice	2	0	0	2
Shock	1	0	0	1
Miscellaneous	10	9	0	19
Total	65	46	6	117

* The New York Hospital-Cornell Medical Center 1946 1958

TABLE 16-18 COMPLICATIONS FOLLOWING MILES ABDOMINOPERINEAL RESECTION IN ELDERLY PATIENTS WITH CANCER OF THE RECTUM*

Complication	*Age yr*			*Total*
	60-69	70-79	80-89	
Cardiovascular respiratory	4	7	1	12
Gastrointestinal	3	2	0	5
Genitourinary	3	2	0	5
Miscellaneous	6	0	0	6
Total	16	11	1	28 (13 [illegible])

The New York Hospital-Cornell Medical Center 1946-1958

16-19 They include all patients operated upon either for palliation or for cure during periods of time making possible follow up periods of 3 or more and 5 or more years

The table discloses a 5 year survival rate of 52 8 per cent in the 60 to 69 year age group 39 7 per cent in the 70 to 79 age group and 25 per cent in the group over 80 The over all 5 year survival rate for the entire group was 47 3 per cent approximately that of any large group

The survival rates in this series like those in practically all others can be fairly well predicted on the basis of lymph node involvement Approximately one third (154 cases) of the 471 patients had involvement of lymph nodes on either gross or microscopic examination (Table 16 20) Most of these patients were dead within 3 years The influence of lymph node involvement on survival rates in cases of cancer of the colon and rectum has been repeatedly noted by others It is of interest that Beal and Cornell in their study of recurrence at the anastomotic site came to the conclusion that the duration of symptoms before treatment the margin between the lesion and the distal transection and the length of bowel removed had little relation to recurrence at the anastomotic site They found that the most important factor was the dissemination of exfoliated cancer cells during operation The significance of lymph node *involvement* was demonstrated by the fact that only 20 7 per cent of patients with positive lymph nodes survived 5 years while 69 4 per cent of those free from such involvement lived 5 or more years The author agrees with Dunphy that most tumors which respond to operation are confined to the organ of origin or

TABLE 16-19 SURVIVAL RATES OF ELDERLY PATIENTS OPERATED UPON FOR CANCER OF THE COLON AND RECTUM *

Age, yr	*No of cases*	*No living without cancer*	*No living with cancer*	*Total living*	*Mortality*
		3 yr survival rates operation 1946–1955			
60–69	212	103 (48 6%)	23 (13 3%)	132 (62 3%)	1 (0 8%)
70–79	108	46 (42 6%)	13 (12 4%)	59 (54 4%)	0
80–89	11	3 (27 3%)	0	3 (27 3%)	3 (27 3%)
Total	331	152 (45 9%)	42 (12 [illegible])	1[illegible]4 (58 0%)	4 (1 2%)
		5-yr survival rates operation 1946–1953			
60–69	168	78 (45 8%)	10 ([illegible] 9%)	88 (52 8%)	9 (5 4%)
70–79	88	32 (36 4%)	3 (3 6%)	3[illegible] (39 7%)	7 (7 9%)
80–89	8	2 (2[illegible] 0%)	0	2 (25 0%)	2 (2[illegible] 0%)
Total	264	112 (41 6%)	13 (4 [illegible])	125 (47 3%)	18 (6 8%)

* The New York Hospital-Cornell Medical Center

TABLE 16-20 EXTENSION OF CANCER IN ELDERLY PATIENTS WITH CANCER OF THE COLON AND RECTUM *

Age yr	No of cases	Lymph node involvement	Liver meta tases
60-69	290	93 (32 1%)	47 (16 2%)
70-79	156	51 (3[illegible] 3%)	20 (12 8%)
80-89	25	7 (28 0%)	3 (12 0%)
Total	471	151 (32 7%)	70 (14 9%)

* The New York Hospital-Cornell Medical Center 1946-1958

are so constituted biologically that their distant metastases are markedly influenced by removing the primary growth

A study of this sort eventually brings the surgeon into contact with a great many statistics purporting to demonstrate various factors affecting the course to be followed in treating the elderly patient for cancer of the colon or rectum One of the cardinal rules however has not been mentioned heretofore Do unto others as you would have them do unto you

BIBLIOGRAPHY

Astler V B and Coller F A The Prognostic Significance of Direct Extension of Carcinoma of the Colon and Rectum Ann Surg 139 846 1954

Bacon H E *Anus Rectum Sigmoid Colon Diagnosis and Treatment* 3d ed J B Lippincott Company Philadelphia 1949

Bacon H E Cancer of the Rectum and Colon A Critical Analysis with Recommendations to Extend the Rates of Survival Surgery 41 387 1957

Bacon H E and McGregor R A Multiple Primary Malignant Tumors of the Colon Report of 141 Cases J Internat Coll Surgeons 28 618 1957

Bader G and Papanicolaou G N The Application of Cytology in the Diagnosis of Cancer of the Rectum Sigmoid and Descending Colon Cancer 5 307 1952

Barden R P and Ritler V W Pre malignant Lesions of the Gastrointestinal Tract Am Surgeon 19 1045 1953

Beal J M and Cornell G N A Study of the Problem of Recurrence of Carcinoma at the Anastomotic Site Following Resection of the Colon for Carcinoma Ann Surg 143 1 1956

The Extent of Cancer Illness in the United States Biometry Branch of the National Cancer Institute Public Health Service Publication No 547 U S Public Health Service National Institutes of Health

Brunschwig A Age of Patients in Relation to Radical Cancer Surgery Geriatrics 11 367 1956

Brunschwig A Complete Excision of Pelvic Viscera for Advanced Carcinoma Cancer 1 177 1948

Buckwalter J A Joiner B A and Ziffren S E Morbidity and Mortality of Abdomino-perineal Resection for Carcinoma in the Elderly J Am Geriatrics Soc 2 450 1954

Cancer in Later Life Stat Bull Metrop Life Insur Co 38 1 1957

Cattell R B Carcinoma of the Rectum at Advanced Age S Clin North America June 721 1954

Cole W H and others Dissemination of Cancer Cells Bull New York Acad Med 34 163 1958

Deddish M R Discussion on the Treatment of Advanced Cancer of the Rectum Proc Roy Soc Med 43 1075 1950

Dixon C F Anterior Resection for Carcinoma Low in the Sigmoid and Rectosigmoid Surgery 15 367 1944

Dorn H F and Cutler S J Morbidity from Cancer in the United States Part I Variation in Incidence by Age Sex Race Marital Status and Geographic Region Public Health Monograph No 29 U S Public Health Service

Dunphy J E Changing Concepts in the Surgery of Cancer New England J Med 249 17 1953

Dunphy J E and Broderick E G A Critique of Anterior Resection for Cancer of Rectum and Pelvic Colon Surgery 30 106 1951

Enquist I F The Incidence and Significance

of Polyps of the Colon and Rectum Surgery 42 681 1957

Ewing J The Relation of Cancer to Old Age Am J M Sc 177 461 1929

Goligher J C Dukes C E and Bussey H J R Local Recurrences after Sphincter saving Excisions for Carcinoma of the Rectum and Recto sigmoid Brit J Surg 39 199 1951

Goligher J C and Smiddy F G The Treatment of Acute Obstruction or Perforation with Carcinoma of the Colon and Rectum Brit J Surg 45 270 1957

Griswold M H Wilder C S Cutler S J and Pollack, E S Cancer in Connecticut 1935–1951 Connecticut State Department of Health Hartford Conn 1955

Howell T H and Piggott A P New Malignant Growths in Old Age Some Points in Morbid Anatomy Geriatrics 13 176 1958

Judd E S Jr and Bellegie N J Carcinoma of Rectosigmoid and Upper Part of Rectum Recurrence Following Low Anterior Resection A M A Arch Surg 64 697 1952

Kirklin J W Dockerty M B and Waugh J M The Role of the Peritoneal Reflection in the Prognosis of Carcinoma of the Colon and Sigmoid Colon Surg Gynec & Obst *88 326 1949*

More Elders in the Population Stat Bull Metrop Life Insur Co *39 4 1958*

Moyer C Address before American Surgical Association April 1958

Nickel W F and Chenowith A Resection of the Rectum with Preservation of the Anal Sphincter Surgery 23 480 1948

State D Combined Abdomino perineal Excision of Rectum Plan for Standardization of Proximal Extent of Dissection Surgery 30 *349 1951*

Sun Yoon D Cancer of the Colon An Analysis of 858 Cases in 20 Years Connecticut M J 22 166 1958

Swinton N W and Counts R L Cancer of Colon and Rectum Statistical Study with End results J A M A 161 1139 1956

Trends in Cancer Mortality Stat Bull Metrop Life Insur Co 39 3 1958

Wangensteen O H The Effectiveness of Surgery in the Management of Alimentary Tract Cancer with Special Reference to the Stomach and Colon Bull New York Acad Med 31 733 1955

Wangensteen O H and Toon R W Primary Resection of the Colon and Rectum with Particular Reference to Cancer and Ulcerative Colitis Am J Surg *75 384 1948*

Wantz G and Glenn F The Treatment of Intestinal Obstruction in the Aged J Am Geriatric Soc 3 974 1955

Waugh J M Miller E M and Kurzweg F T Abdominoperineal Resection with Sphincter Preservation for Carcinoma of the Mid rectum A M A Arch *Surg 68 469 1954*

Welch C E and Giddings W P *Carcinoma* of Colon and Rectum Observations on Massachusetts General Cases 1937–1948 New England J Med *244 859 1951*

Welch C E and Whittemore W S Carcinoma of the Rectum in a Centenarian New *England J Med 250 1041 1954*

Wilson J S and Tennant R Cancer of the Colon A 10 Year Study Cancer 11 278 1958

Zeifer H D and Colp R The Surgical Tolerance of the Elderly Patient Review of 148 Selected Cases of Biliary Tract Gastric and Colonic Lesions J Am Geriatrics Soc 5 284 1957

17

Diverticulitis

Richard C Karl

In recent years increasing numbers of patients with diverticulitis of the colon have required surgical therapy This is due not only to the greater proportion of elderly patients in our population but also to newer methods of management which have lessened the risks and extended the indications for surgery

Because all available statistical studies on the incidence of diverticulosis of the colon have been based on some degree of selectivity in the groups of patients studied the exact percentage of the population and of various age groups in the general population with this pathologic change is unknown The objection to the large autopsy series is that there is a preponderance of older persons Furthermore during postmortem examinations diverticula may be overlooked on gross inspection unless special techniques are used Radiologists have reported the incidence of diverticulosis in all patients undergoing barium enema examinations However such groups are selected in that usually some abdominal complaint had been present before the x ray examination was made In spite of these limitations most investigators place the incidence of diverticulosis between 5 and 10 per cent in all persons over 40 years of age Diverticula of the colon are seldom seen in patients under 35 years of age The frequency of their occurrence thereafter progressively increases so that the incidence is quite high in the very aged

The rectum usually is not involved in the pathologic process Diverticula are most often found in the sigmoid and rectosigmoid segments of the colon Spriggs and Marxer in a study of 166 consecutive patients with diverticulosis noted diverticula in the sigmoid and rectosigmoid in 72 per cent in the entire colon in 14 4 per cent in the cecum in 4 8 per cent and in the rectum in 2 4 per cent

The exact etiology of diverticulosis is unclear The diverticula are outpouchings of mucosa through the muscularis They may be at the sites of emergence of vessels through the muscularis They may be found anywhere about the circumference of the large intestine but usually do not project through the taenia coli Often they protrude along the taenia and frequently extend into appendices epiploicae or into the mesentery of the colon

It is difficult to determine accurately the percentage of persons with diverticulosis who will develop diverticulitis Most estimates vary between 10 and 27 per cent It is likely that many patients with mild symptoms do not present themselves for thorough evaluation

Diverticulitis occurs somewhat more commonly in males It is relatively infrequent in patients under 40 years of age and the greatest incidence in all series is in either the sixth or the seventh decade of life Although diverticulitis may occur in any segment of the bowel in which there are diverticula the right side of the colon is apparently less often involved than the incidence of diverticulosis

in this portion of the large bowel might suggest This may be related to the more fluid character of the stool and to the absence of stasis in this area The sigmoid and rectosigmoid segments are most frequently involved in the pathologic process

SIGNS AND SYMPTOMS

The symptoms associated with diverticulitis vary in degree with the acuteness severity and location of the primary pathologic process Typically uncomplicated acute diverticulitis is characterized by cramping or aching left lower quadrant abdominal pain and tenderness constipation or diarrhea anorexia and, often nausea and vomiting There may be some temperature elevation Physical examination may reveal only deep tenderness to pressure over the sigmoid colon or there may be more marked evidence of peritoneal irritation with reflex spasm A mass may or may not be felt either transabdominally or rectally Recurrent episodes are not infrequent

Numerous complications of acute diverticulitis may occur and these are manifested by more serious signs and symptoms These complications include perforation with generalized or regional peritonitis abscess formation fistula formation obstruction hemorrhage, and, rarely suppurative pylephlebitis

Acute perforation may occur without any previous symptoms of diverticulitis The onset of the abdominal pain is abrupt and may extend over the entire abdomen if generalized peritonitis ensues Anorexia nausea and vomiting are frequent and there may be evidences of peripheral vascular collapse If the perforation is walled off by the omentum and adjacent loops of small bowel the findings are those of a regional peritonitis If the perforation occurs into the sigmoid mesocolon or into the retroperitoneal space a localized abscess may develop and a mass may become evident Such abscesses may assume considerable size Occasionally localized abscesses drain spontaneously into the lumen of the bowel Involvement of the left adnexal structures may produce a tubo ovarian abscess

If the inflammatory lesion in the colon becomes adherent to adjacent structures slow perforation may occur and ultimately result in fistula formation Fistulas may develop between the involved segment of bowel and the bladder, vagina, uterus abdominal wall small intestine, ureter, urethra, and perineum

Mayo and Blunt reviewed the findings in 46 patients with vesicosigmoidal fistulas complicating diverticulitis In most cases the major symptoms were referable to the urinary tract Abdominal pain recurrent fever dysuria or urinary urgency or frequency were often present for several weeks before the onset of pneumaturia Approximately 2 weeks after pneumaturia appeared pain frequently was noted in the perineal suprapubic or genital region About 3 months later feces was noted in the urinary stream Approximately 1 year after this some patients noted gross hematuria These authors also noted that the onset of pneumaturia sometimes followed inflation of the sigmoid during sigmoidoscopy One patient stated that he passed urine from the rectum when his bladder was full Barium enema studies demonstrated the vesicosigmoidal fistulas in only 20 per cent Changes suggesting the presence of a fistulous communication were noted on cystoscopy in 84 8 per cent Fistulas between the sigmoid colon and bladder occur with much greater frequency in males It is felt that the interposition of the uterus is a major factor in the decreased incidence in females A sigmoidouterine fistula should be considered in any patient with diverticulitis and pyometra

Since carcinoma is a frequent cause of fistula formation the possibility of a concurrent malignancy is to be included in the differential diagnosis in patients with this complication

Symptoms of large bowel obstruction may be evident during the acute phase of diverticulitis In such instances the obstruction is

related to edema associated with the acute inflammatory reaction and disappears as the process resolves. Repeated episodes of acute inflammation and associated multiple small pericolonic abscesses may incite a severe cicatricial reaction. This causes marked shortening and narrowing of the involved segment of colon. Not only does the compromised lumen obstruct the flow of stool but the fibrosis prevents effectual peristaltic contractions in the scarred portion of intestine.

Occasionally an adjacent loop of small intestine becomes adherent during an acute inflammatory phase and sufficient distortion ensues to produce acute small bowel obstruction.

Gastrointestinal hemorrhage secondary to diverticulitis of the colon has been reported with varying frequency. Most writers place the incidence between 8 and 26 per cent. In the great majority of these patients the bleeding is of mild degree. It may be noted by the patients or it may manifest itself only as occult blood on chemical examination. Because blood loss is so frequently associated with other intestinal abnormalities and particularly with benign and malignant neoplasms it is extremely important that these be considered and sought for in any patient with diverticulitis and gastrointestinal hemorrhage. Bleeding from carcinoma of the colon is much more common than is bleeding from diverticulitis and it is more likely to be persistent. The mechanism of hemorrhage in diverticulitis is thought to be erosion of a vessel related to a diverticulum as a result of pressure trauma infection or ulceration. Inversion and erosion of a diverticulum has been suggested as a cause by some.

Acute massive intestinal hemorrhage occasionally occurs secondary to diverticulosis and diverticulitis. The bleeding may be so severe that immediate surgical intervention is necessary in order to prevent loss of life. Hoar and Bernard in an excellent review of the problem stated "Given an elderly hypertensive patient with exsanguinating colonic hemorrhage in the presence of diverticula disease, the decision to operate should be made early after the initial blood replacement and chart stabilization have been achieved. A 12 hour period of observation should be sufficient in this situation. Severe hemorrhage in an elderly patient with coronary artery disease may precipitate an acute coronary occlusion."

ROENTGENOLOGIC FINDINGS

The barium enema examination is the most useful diagnostic procedure in the management of diverticulitis. Correlation of the roentgenologic findings with the pathologic lesions has enabled radiologists to demonstrate the changes that may occur in this disorder with considerable accuracy. This is especially important in differentiating diverticulitis from carcinoma of the colon. Goulard and Hampton and Wolf Khilnani and Marshak have recently reviewed the radiologic findings in detail. The changes that may be seen are both anatomic and functional. The former are predictably reproducible while the latter may also be reproducible but the abnormal configuration is usually variable either during the initial examination or on repeated ones. Wolf and his coworkers emphasized the importance of the use of spot films in order to demonstrate small lesions which may be eccentrically located. They also recommended the employment of air studies in order to obtain maximum distention of the large intestine. The air studies are of value in outlining the mucosal changes which may be present.

The functional findings that may be seen include limited distensibility of the bowel and spasm. The inability of the bowel wall to distend fully is often accompanied by a failure to elongate normally. The spasm causes narrowing of the lumen for a considerable period and may be demonstrated as a functional change only on serial studies.

The most frequently encountered anatomic finding of course is the demonstration of the diverticula with barium. Characteristically the contrast medium is retained

in the diverticular pockets after the evacuation of the barium enema Because the inflammatory reaction may occlude the orifices of involved diverticula these may not be demonstrated in the presence of diverticulitis and the barium enema may appear normal

Fibrosis and shortening of the involved colonic segment along with thickening of the mucosal folds produce a permanent defect which appears as *serrations on the barium enema films* This appearance has been termed *saw tooth deformity* and is the result of previous inflammation and cicatrization Localized abnormalities in the wall of the bowel are due to limited areas of inflammation and are best visualized by the use of the spot film technique on the distended bowel When present fistulous tracts may be demonstrated and abscess cavities may be filled with barium These tracts and cavities often *retain the barium and their presence and* configuration may be shown most clearly on *the postevacuation films As stated earlier* vesicosigmoidal fistulas are revealed with barium studies in approximately 20 per cent of the instances where they are present

SIGMOIDOSCOPY

This examination is seldom of value in establishing a diagnosis of diverticulitis Occasionally the orifices of *diverticula may* be seen or spasm and limited mobility of the rectosigmoid colon may be demonstrated Probably the major contribution that this study affords is that it may reveal the presence of associated polyps or tumors of the rectum and rectosigmoid which might otherwise go unsuspected

DIVERTICULITIS AND CARCINOMA

One of the major diagnostic problems encountered in patients with diverticular disease of the colon is the differentiation between diverticulitis and concomitant carcinoma of the large bowel Both disorders occur in the same age groups *and may cause* symptoms of abdominal pain, constipation or diarrhea rectal bleeding and fever Perforation into the general peritoneal cavity and fistula formation may occur with either lesion A mass may be present with either process and the radiologic findings may be confusing Both pathologic entities may be in the same segment of bowel, or different segments may be involved Left lower quadrant pain fever and urinary symptoms oc*cur more commonly with diverticulitis* while progressive weight loss and persistent rectal bleeding are more frequent with carcinoma Sigmoidoscopy is sometimes helpful in that many carcinomas of the distal colon may be visualized and biopsied Examination of colonic irrigation fluid for abnormal cells by the Papanicolaou technique may be useful The diagnostic procedure of greatest value in differentiating diverticulitis from colon malignancy is careful roentgenologic exami*nation and interpretation Fraser and Peirce* emphasized three main observations (1) *the presence* or absence of diverticula, (2) the character of the mucosal pattern, with preservation of the mucosa in diverticulitis and destruction in carcinoma and (3) the length and contour of the lesion which is long and ill defined in diverticulitis and short and sharply defined with overhanging edges in carcinoma *Significant clinical and x ray* evidence of improvement may occur with *antibiotic therapy in diverticulitis* but not in carcinoma

Rauch has recently reviewed 118 patients having both diverticulitis and carcinoma of the colon He noted that the coexisting lesions were in the same segment of *bowel in* 73 per cent The carcinoma was *located distal to the area of diverticulitis in* 17 per cent and proximal to it in 10 per cent At operation 77 per cent had lesions which were potentially curable and underwent radical excisional therapy while 23 per cent were felt to be incurable and had lesser procedures performed The 5 year cure rate was *found to be less with the two diseases* coexisting than in patients with carcinoma alone When there were regional lymph node

metastases and associated diverticulitis is well the 5 year cure rate was especially bad (11 per cent) Although the concurrence of both disorders is infrequent the physician should be continually alert to this possibility Delay in diagnosis markedly diminishes the prospects of 5 year survival It is obvious that when carcinoma is suspected resection of the involved colon should be undertaken as soon as the patient s condition permits If a diverting colostomy is necessary in the patient s management resection should not be delayed longer than 4 weeks

MEDICAL THERAPY

The type of treatment employed is of course dependent upon the magnitude of the pathologic process and the severity of the patient s symptoms It is usually unnecessary to prescribe any specific dietary restrictions or medications for persons with uncomplicated asymptomatic diverticulosis Low residue diets with avoidance of condiments and the use of mineral oil to prevent constipation have been recommended for many years for patients with symptoms of mild diverticulitis Some gastroenterologists have expressed doubt as to the value of low roughage diets in this condition Antispasmodics and phenobarbital have frequently been added to this regimen Small warm oil retention enemas are sometimes indicated if constipation is marked Patients with diverticulitis should not be given more vigorous enemas

When the symptoms of acute diverticulitis are of greater intensity and particularly when fever nausea and vomiting and more marked abdominal pain are present hospitalization is usually indicated Medical therapy then usually includes bed rest nothing by mouth parenteral feedings and often antibiotics An intragastric tube connected to a negative pressure system may be required if an ileus is present or if the symptoms of obstruction are evident As the patient s condition improves the indwelling tube may be removed oral feedings gradually instituted and ambulation begun After the acute phase has subsided thorough roentgenologic evaluation is to be undertaken in order to confirm the initial clinical impression Patients having recurrent episodes of acute diverticulitis should be considered for surgical therapy during a quiescent phase

In the older age groups many complicating concurrent and intercurrent illnesses may be present These require appropriate management which may in part require some compromise from the ideal therapy for the acute diverticulitis Bed rest and prolonged intragastric intubation are undesirable in the very elderly patient Cardiovascular disorders necessitate great care in the employment of parenteral fluids and electrolytes The cooperative efforts of both internist and surgeon are often required

SURGICAL THERAPY

For many years surgical treatment in the management of diverticulitis of the large bowel was limited to those patients in whom complications of the disease were present Perforation obstruction fistula formation and severe hemorrhage were and still are unequivocal indications for surgical intervention With the advances in surgical methods and especially with the advent of antibiotics better bowel preparation regimens clearer understanding of nutritional and electrolyte abnormalities and improved anesthesia techniques the operative morbidity and mortality risks have decreased steadily As a result increasing numbers of patients with uncomplicated diverticulitis are being treated surgically In this group are included patients with repeated episodes of acute diverticulitis but without any of the severe complications of the disease patients who have had one severe acute attack and patients with lesions that suggest the possibility of coexisting malignancy

Once operative intervention is deemed necessary the plan of therapy should include resection of the diseased segment of colon In the past transverse colostomies

were sometimes performed for acute symptoms, and later, with the subsidence of the acute process the colostomies were closed without removing the primary pathologic lesion Follow up studies on such patients revealed a large proportion of unsatisfactory results

Resection of the diseased portion of bowel and reestablishment of the continuity of the bowel may be accomplished with a three-, two- or one stage procedure The three-stage technique was used almost exclusively for many years This was the result in part of the fact that only patients with severe complications of diverticulitis were offered surgical therapy and in part of the unavailability of antibiotics and adequate bowel preparation methods The three stage operation continues to be the procedure of choice when there is perforation into the general peritoneal cavity, when there are large abscesses when there are large fistulas and on the rare occasions when there is complete large bowel obstruction At the time of the first operation a defunctioning transverse colostomy is performed This is placed in the right upper quadrant where it will not interfere with mobilization of the splenic flexure at the time of the resection of the diseased sigmoid colon If there has been perforation with resultant generalized peritonitis or large abscess formation the perforation should be closed if it can be visualized readily The region of the perforation should be drained The drains are brought out through a left lower quadrant stab wound Some surgeons object to the policy of draining such areas because enterocutaneous fistulas occasionally result However the establishment of adequate drainage is important in controlling loculated purulent material Postoperative management includes intragastric tube aspiration parenteral feedings and appropriate antibiotics After the acute inflammatory episode has subsided a barium enema should be used in order to demonstrate the lesion radiographically If the possibility of a carcinoma is suggested resection of the involved segment of colon is indicated 2 to 4 weeks after the initial operation instead of after the usual interval of 3 months

Resection of the area of diverticulitis is performed at the second operation of the three-stage procedure Preoperative preparation of the colon includes daily irrigations of the distal loop of the colostomy and instillation of one of the locally effective antibiotics It is important to remove an adequate segment of the diseased bowel at this time, otherwise recurrent symptoms are likely The sites chosen for transection of the bowel should be well above and well beyond the diseased area The bowel wall at these sites must be free of inflammation in order to insure uncomplicated healing of the anastomosis It is unnecessary to resect all of the diverticula present if they are well away from the area of diverticulitis When the preoperative studies or the operative findings are compatible with carcinoma the resection should be performed in a radical fashion so that the lymph nodes draining the involved segment of colon are removed Then occluding ligatures should be placed about the bowel proximal and distal to the mass in order to prevent intraluminal spillage of tumor cells Early in the procedure the venous drainage of the area should be divided so that intravascular tumor cell emboli may be prevented Regardless of whether or not a malignancy is suspected examination of the specimen by the surgical pathologist as soon as it is removed is advised for a carcinoma may be present If it is a radical excision of the mesentery adjacent to the resected bowel can be performed If a fistula is present it should be removed with the specimen and the resultant defect in the organ secondarily involved appropriately closed An adequate anastomosis requires that the approximated bowel have sufficient blood supply and that it be free of inflammation and tension An open two-layer anastomosis is made using interrupted silk sutures

If the patient's postoperative course is uneventful and if his general condition otherwise permits colostomy closure, the third

and final stage of the procedure may be performed between 2 and 4 weeks after the area of diverticulitis has been resected Prior to operation patency of the anastomosis may be confirmed by irrigating the distal colostomy loop If there is any doubt about the anastomosis a barium enema study should be made

Primary resection of the diseased segment of bowel without preliminary colostomy is being performed with increasing frequency The desirability of avoiding a three stage procedure with the necessary prolonged period of treatment is obvious This approach is particularly well suited for the patient who has had recurrent acute attacks but in whom the inflammatory reaction is in a quiescent phase Other indications for primary resection included incomplete obstruction where an adequate preoperative bowel preparation can be obtained diverticulitis with associated small fistulas diverticulitis with encapsulated mesosigmoid or small peridiverticular abscesses and exsanguinating colonic hemorrhage secondary to diverticulosis or diverticulitis

The current trend in all published series leans heavily toward the single stage procedure and the operative morbidity and mortality figures are very low It is necessary however to emphasize that not all patients with diverticulitis requiring surgical therapy are suitable candidates for primary resection Except for those with life endangering large bowel hemorrhage in general patients with severe complications or those who are critically ill should have multiple stage resections

The two-stage procedure includes a proximal colostomy at the time of primary resection of the diseased bowel The colostomy is indicated when the anastomosis appears insecure for any reason for many of the postoperative complications are related to leakage at the anastomotic suture line

When exploration and resection are undertaken because of massive colonic bleeding it may be extremely difficult to locate the site of the acute hemorrhage Often the entire colon is filled with blood and there may be diverticula throughout it In such a circumstance multiple colotomies may be necessary After the bowel segments are irrigated a sterile proctoscope may be introduced and the mucosal surface of most of the large bowel visualized If this fails to reveal the bleeding point saline irrigation of the various segments may localize the area for the irrigation returns should be clear from all segments except the one which contains the source of the hemorrhage This portion of colon should then be resected

An occasional patient may be encountered with acute right sided abdominal pain who on exploration is found to have a sealed-off perforated diverticulitis of the ascending colon Often a right hemicolectomy may be performed in this situation at the time of the initial operation It is stated that this is tolerated well because of the liquid nature of the stool in the terminal ileum which prevents stasis at the site of anastomosis

THE NEW YORK HOSPITAL EXPERIENCE

During the 25 year period from 1933 to 1958 there were 246 patients 60 years of age or older with diverticulitis of the colon admitted to The New York Hospital–Cornell Medical Center and treated on the surgical pavilion In some the disease was concurrent with a more serious primary illness which necessitated hospitalization One hundred sixty five patients were treated medically The therapy ranged from moderate diet restrictions to regimens including bed rest intestinal intubation for prolonged periods parenteral feedings massive antibiotic therapy and multiple transfusions Five patients in this group had marked rectal bleeding One 78 year old male with severe blood loss refused surgical intervention and survived A 63 year old man died of a coronary occlusion secondary to massive rectal bleeding Three patients with considerable but less marked hemorrhage recovered with conserv

ative management Of those treated medically, only a small percentage subsequently developed marked symptoms of recurrent diverticulitis There were two instances in which carcinoma of the rectum occurred later

Eighty one patients received some type of surgical intervention in order to control the disease process Exploration of the abdomen with or without drainage of the peritoneal cavity was performed on 11 patients Many of these were operated upon early in the series and the procedure was done in an attempt to exclude the presence of a carcinoma In others, generalized peritonitis or a perisigmoidal abscess was the indication for surgery When the site of acute perforation was identified plication was accomplished Postoperative management included intestinal intubation and antibiotics when they became available One of the 6 patients with abscess formation subsequently required a transverse colostomy It is the policy now to perform proximal colostomies on all patients with acute perforations of the colon Only one cecostomy was done as the primary surgical operation In general when decompression of the large bowel is necessary, a colostomy should be employed

Eleven patients were treated with proximal colostomy with or without drainage of the peritoneal cavity Six of the 11 had obstruction 2 had perforation of the sigmoid with peritonitis 2 had inflammatory masses and 1 had a vesicosigmoidal fistula In most the colostomy was the first stage of a planned three stage procedure However further management was not possible in all but 1 because of death or refusal of the patient to accept additional surgery In two instances unanticipated carcinoma with hepatic metastases was encountered One of the patients with an inflammatory mass developed a fistula between the terminal ileum and bladder which required excision several years later

Colostomy and subsequent colostomy closure without resection of the diseased segment of bowel was the method of management in 8 patients The indications for surgical therapy were the presence of a mass or partial colon obstruction in 4, peritonitis in 3 and a vesicosigmoidal fistula in 1 There was an adequate follow-up in 7 of the 8 patients One had recurrent symptoms 12 years after colostomy closure, and 6 were well One additional patient is included among those who were resected This patient was initially treated with a transverse colostomy and later closure Severe recurrent symptoms eventually necessitated resection For several years excision of the involved bowel has been recommended for any patient who has symptoms severe enough to warrant colostomy

Resection of the segment of colon containing the area of diverticulitis was accomplished in 50 patients Indications for operation included obstruction in 17 recurrent disabling symptoms in 13 severe hemorrhage in 5 (3 in this group required emergency resection in order to prevent exsanguination) peritonitis in 4 abscess in 3, suspicion of carcinoma in 2 carcinoma in 2 vesicosigmoidal fistula in 2 and 1 patient with large and small bowel obstruction and a sigmoidovaginal fistula simultaneously

The most frequent method of resection was the three stage procedure which was performed on 21 patients In 3, obstruction at the site of colostomy closure occurred additional surgical operations were necessary to relieve this complication in each instance Primary resection was the next most common method of management and it has been employed with increasing frequency in recent years Patients most suited for this approach have been those with recurrent disabling symptoms of diverticulitis who are in a quiescent phase of the disease and those with lesions which cannot be differentiated from carcinoma Obstructive resections were performed in three instances in the early years of the series Two stage resections were done in 3 patients in whom bowel preparation was inadequate Two of these had emergency procedures for massive hemorrhage, and 1 had considerable local in

flammation secondary to a walled-off perforation Preliminary proximal colostomy followed by resection of the involved segment of bowel but without colostomy closure was performed on 6 patients Three of these patients died before the colostomies could be closed and 2 had abdominoperineal resections 1 for carcinoma of the rectum and 1 for tuberculous colitis Another patient had a malignant rectal polyp and a carcinoma of the descending colon in addition to diverticulitis of the descending and sigmoid portions of the large bowel

Among the 81 patients treated surgically there were 10 operative deaths Two deaths were attributable to each of the following overwhelming peritonitis renal failure and pseudomembranous enterocolitis Arteriosclerotic heart disease pulmonary embolus hemorrhage from esophageal varices and cardiac arrest during colostomy closure were considered the causes of death in 4 patients

The concurrent finding of diverticulitis and carcinoma of the colon rectum or anus occurred in 7 of the 81 patients operated upon In 2 the finding was unanticipated There were 3 patients who had from one to three benign polyps in the resected specimens

Excision of the areas of diverticulitis has resulted in relief of symptoms in all but 2 patients One had a 45-cm segment of descending and sigmoid colon resected but has since developed diverticulitis in the remaining large bowel Another a 76-year-old woman developed ulcerative colitis which responded to steroid therapy She is now symptom free and does not require any medication

BIBLIOGRAPHY

Fraser R G and Peirce C B The Differentiation of Diverticulitis and Carcinoma of the Large Bowel A Roentgenologic Problem J Canad A Radiologists 1 39 1950

Goulard A Jr and Hampton A O Correlation of the Clinical Pathological and Roentgenological Findings in Diverticulitis Am J Roentgenol 72 213 1954

Hoar C S and Bernard W F Colonic Bleeding and Diverticular Disease of the Colon Surg Gynec & Obst 99 101 1954

Mayo C W and Blunt C P Vesicosigmoidal Fistulas Complicating Diverticulitis Surg Gynec & Obst 91 612 1950

Rauch R F Coexisting Diverticulitis and Carcinoma of the Colon A M A Arch Surg 73 823 1956

Spriggs E I and Marxer O A Multiple Diverticula of the Colon Lancet 1 1067 1927

Wolf B S Khilnani M and Marshak R H Diverticulosis and Diverticulitis Roentgen Findings and Their Interpretation Am J Roentgenol 77 726 1957

18

Intestinal Obstruction

George E. Wantz

That deaths from mechanical intestinal obstruction among the aged can be materially reduced by the early application of sound therapeutic measures has been demonstrated by the experience of many surgeons. The greater mortality in elderly patients with intestinal obstruction is the result of the consequences of the primary pathology (e.g. shock, peritonitis, perforation, fluid and electrolyte loss, aspiration pneumonitis) rather than of the sequelae of advanced age. While this does not mean that increased vulnerability and the decreased viability and adaptability of senescence do not adversely modify the effects of intestinal obstructions, it does, however, emphasize the fact that better results are possible.

Surgeons sometimes underestimate the ability of the aged to withstand extensive procedures. Provided that preoperative preparation is meticulously carried out and postoperative care is skillfully managed, the results of geriatric surgery compare favorably with those for similar operations in younger persons.

The high mortality rate from intestinal obstruction in the aged plus the observation that this condition is most common during old age constitute good reasons to direct increased attention toward the problem.

INCIDENCE AND MORTALITY

Intestinal obstruction is a disease of advancing years. About 40 per cent of all patients with intestinal obstruction are past the age of 60, and a third of the patients are among the small segment of the population past 65 years of age. The fact that the causes of intestinal obstruction are, in most instances, prone to occur in the aged gives rise to its predominance in these individuals. The common causes of intestinal obstruction, however, are as likely to produce intestinal obstruction in young adults. Therefore intestinal obstruction itself is not truly an age-linked disease.

Intestinal obstruction is the most common reason for acute abdominal emergencies in the aged, probably because of its high incidence in this group. Experience in many large clinics, as well as among individual surgeons, indicates that more than half of the emergency abdominal operations in the elderly are for intestinal obstruction. At The New York Hospital–Cornell Medical Center operations for intestinal obstruction constitute 55 per cent of the common acute abdominal diseases requiring emergency surgical therapy and are performed more than twice as frequently as operations for acute cholecystitis (Table 18.1).

Intestinal obstruction has a high mortality rate among aged individuals. The vital statistics of the United States show that 4,829, or 57 per cent, of the 8,453 deaths due to intestinal obstruction and hernia in 1956 occurred in the group over the age of 65 years. During that year intestinal obstruction and hernia ranked fourteenth among causes

TABLE 18-1 RELATIVE FREQUENCY AND MORTALITY RATES OF THE COMMON ACUTE ABDOMINAL DISEASES REQUIRING SURGERY IN PATIENTS 65 YEARS OF AGE AND OLDER *

Disease	*No of cases*	*No of deaths*	*Mortality rate %*	*% of total*
Intestinal obstruction	200	35	17.5	55.4
Acute cholecystitis	88	5	5.7	24.4
Appendicitis	64	3	4.7	17.7
Perforated peptic ulcer	9	4	44.5	2.5
Total	361	47	13.0	100.0

* The New York Hospital Cornell Medical Center 1944–1957

of death in this age group whereas they ranked seventeenth for the population as a whole (Table 18-2)

The recently reported mortality rates of intestinal obstruction in the aged tabulated in Table 18-3, vary so widely (2.8 to 58 per cent) that an unequivocal appraisal of this rate is impossible Statistical analyses may be affected by many hidden variables and the death rate in any series may depend on factors unrelated to the methods of diagnosis and treatment The period of the analysis age of the patient the cause and duration of the obstruction degree of bowel distention and the presence of gangrene or peritonitis are only a few of the factors that may significantly alter mortality The figures derived from the surgical pavilion patients 65 years of age or older seen at The New York Hospital–Cornell Medical Center from 1944 through 1957 indicate that the patient mortality rate for intestinal obstruction (197 patients 35 deaths) was 17.7 per cent and that the case mortality rate (200 cases 35 deaths) was 17.5 per cent However in the elderly the mortality increases with age so that it is 50 per cent in patients past 85 years of age (Table 18-4)

Although mortality figures differ greatly a constant finding in analyses of fatal cases is that the overwhelming majority of deaths are the result of the primary pathology or its treatment That the effects of old age and its degenerative diseases provided they are duly regarded are of less importance in contributing to the high mortality of intestinal obstruction is clearly demonstrated in the author s case review (Table 18-5)

TABLE 18-2 DEATHS DEATH RATES PER 100 000 POPULATION AND RANK FOR HERNIA AND INTESTINAL OBSTRUCTION UNITED STATES 1956 *

Race age and sex	*No*	*Rate*	*Rank*
All races both sexes			
All ages	*8,453*	*5.1*	*17*
25–44 yr	444	0.9	18
45–64 yr	1,898	5.6	15
65 yr and over	4,82[illegible]	33.5	14
White males			
All ages	3,762	5.1	18
25–44 yr	133	0.6	19
45–64 yr	794	5.2	16
65 yr and over	2,178	35.2	16
White females			
All ages	3,689	4.9	14
25–44 yr	187	0.9	16
45–64 yr	751	4.8	13
65 yr and over	2,311	31.9	11

Includes only deaths occurring within the continental United States Deaths classified to International List Numbers 560 561 570 Rank based on position in list of 64 Selected Causes of Death For method of ranking see Leading Causes of Death United States and Each State and Alaska Hawaii Puerto Rico and the Virgin Islands (U S) 1955 *Vital Statistics–Special Reports* Vol 46 No 8

SOURCE Published and unpublished data of the National Office of Vital Statistics Numbers of deaths by age sex and race and cause of death are published in *Vital Statistics of the United States* 1956 *Part II*

TABLE 18 3 MORTALITY RATE ACUTE INTESTINAL OBSTRUCTION IN AGED PATIENTS

Source	Period of analysis	Minimum ag of patients yr	No of cases	Mortal ity %
The New York Hospital-Cornell Medical Center	1914–1957	65	200	17 5
Becker Davis and Lehman	1933–1947	61	107	25 2
Benedeck and Raffucci	1947–1955	61	64	10 9
Bohlmann	1935–1954	70	216	58 0
Bollinger and Nobles	1945–1953	70		19 2 *
Cutler	1939–1949	60	123	57 0
Drugus and Shaff	1945–1950	61	25	24 0 *
Ferguson Smith and Houston	1944–1948	60	210	53 8
Goldstein Beye and Zifron	1945–1951	65	92	25 0
McLaughlin and Brush	1946–1949	60	37	2 8
Owen and Murphy	1945–1949	70	86	37 2
Standeven †		70	84	25 0
Wangensteen	1942–1953	61	500	15 7
Wantz and Glenn	1944–1954	65	120	15 1
Welch	1947–1955	70		37 7

* Small bowel obstruction only
† Reported in 1955

Only general conclusions may be derived from this material, and these are (1) that the mortality rate for intestinal obstruction in geriatric patients is high and increases abruptly among very old individuals (2) that the mortality rate of 15 per cent attributed currently to the all age group of patients with intestinal obstruction principally represents deaths among the elderly (3) that, although there has been a gradual and steady decline in the mortality, the problems of intestinal obstruction especially in the aged are far from solved

TABLE 18-4 MORTALITY OF INTESTINAL OBSTRUCTION IN AGED PATIENTS *

Age yr	No of patients †	No of deaths ‡	Mortal ity %
65–69	84	16	19 1
70–74	50	8	16 0
75–79	40	3	7 5
80–84	20	5	25 0
85+	6	3	50 0
65+	200	35	17 5

* The New York Hospital-Cornell Medical Center 1914–1957
† Average age of patients 71 9 yr
‡ Average age at death 71 8 yr

TABLE 18 5 CAUSE OF DEATH IN 200 PATIENTS 65 YEARS OF AGE AND OVER WITH MECHANICAL INTESTINAL OBSTRUCTION *

Causes of death	No of deaths	Per cent of total
Shock or peritonitis secondary to distention †	13	37 2
Shock or peritonitis secondary to operation	3	8 6
Cardiovascular	8	22 9
Coronary occlusion	2	
Congestive heart failure	1	
Cerebral vascular accident	2	
Cardiac arrest	3	
Pulmonary embolus	3	8 6
Pneumonia staphylococcal	1	2 8
Septicemia (diverticulitis)	1	2 8
Fluid and electrolyte imbalance	1	2 8
Carcinomatosis	5	14 3

* The New York Hospital-Cornell Medical Center 1914–1957
† One patient moribund on admission In four patients an antemortem diagnosis of intestinal obstruction was not made

TYPES AND CAUSES OF OBSTRUCTION

While the term *ileus* is applicable to intestinal obstruction from any cause common usage reserves it to designate those resulting from failure or absence of peristaltic activity and inability to maintain intestinal tone However to avoid confusion intestinal obstruction of this type should be indicated by the more descriptive terms *paralytic ileus* *Adynamic* and *reflex* inhibition are also used to describe intestinal obstructions caused by a condition preventing normal peristaltic activity The bowel in paralytic ileus is anatomically normal Normal peristalsis is absent however presumably for want of adequate nervous or chemical stimulation Functional obstructions may also be spastic in nature but these are rare

Far more common than paralytic obstruction or ileus are the mechanical or organic obstructions These are characterized by partial or complete blockage of the progress of intestinal contents by some definite physical barrier Mechanical intestinal obstruction may be acute or chronic the former resulting from sudden blockage of the bowel and the latter implying recurrent partial occlusion Although acute obstructions are more important surgically some of them chiefly those in the large bowel due to cancer or inflammation may be preceded by a prolonged period of chronic obstruction

The terms *high intestinal obstruction* and *low intestinal obstruction* are sometimes used to designate the level of the pathologic process and closely reflect the clinical features of small and large bowel obstructions High intestinal obstruction indicates obstruction of the upper jejunum but more accurately implies serious water and electrolyte deficits Low intestinal obstruction refers to obstruction of the colon or lower ileum when abdominal distention and consequently respiratory and circulatory embarrassment appear to predominate

Both clinical and pathologic considerations require that regardless of underlying cause mechanical obstruction must be subdivided and recognized according to whether it is simple or involves strangulation In simple mechanical obstruction the lumen of the bowel is occluded but there is no interference with the blood supply to the involved segment Strangulation obstruction on the other hand involves both intraluminal obstruction and partial or complete occlusion of the mesenteric arteries or veins serving the segment Although gangrene may not necessarily be present in a strangulating obstruction failure to relieve the obstruction may well guarantee its development The only way to ascertain whether a given intestinal obstruction is strangulated is to examine the bowel directly[7]

Strangulation is frequent (42 5 per cent) in aged patients and of the many types of obstruction it is the most fatal especially if the bowel is gangrenous (Table 18 6) The deadly effects of necrotic bowel are emphasized by the fact that although present in only 17 per cent of patients with intestinal obstruction it was a finding in 40 per cent of the deaths In fact the only deaths in patients with strangulation obstruction occurred among those with gangrene

Closed loop obstruction volvulus intussusception and occlusion of the mesenteric vessels are types of intestinal obstruction in which strangulation is a characteristic feature Volvulus is a torsion of a loop of intestine on its mesentery resulting in occlusion of its ends and of its mesenteric vessels Intussusception is a telescoping or invagination of one segment of intestine into another and although a frequent form of intestinal obstruction in youngsters rarely occurs in the elderly In the older population it is nearly always secondary to a tumor usually a benign polyp which provides the focal point of the invagination It is usually accompanied by strangulation of the invaginated bowel or intussusceptum and since this is shielded by a sheath of bowel called the intussuscipiens only minimal abdominal tenderness may be present

Closed loop obstruction is a form of the

TABLE 18 6 MORTALITY SIMPLE AND STRANGULATION OBSTRUCTIONS IN PATIENTS AGE 65 AND OLDER *

Pathologic type of intestinal obstruction	Small intestine			Large intestine		
	No of patients	No of deaths	Mortality %	No of patients	No of deaths	Mortality %
Simple obstruction †	53	6	11 3	58	12	20 7
Simple obstruction with perforation ‡	2	1	50 0	2	1	50 0
Strangulation obstruction without gangrene §	41	0	0	8	0	0
Strangulation obstruction with gangrene §¶	34	14	41 2	2	1	50 0

* The New York Hospital-Cornell Medical Center 1944-1957

† Simple obstruction including perforation occurred in 57 5 per cent of series with 17 4 per cent mortality

‡ Perforation occurred in 2 per cent of the patients in this series

§ Strangulation obstructions with and without gangrene constituted 42 5 per cent of series with 17 6 per cent mortality

¶ Gangrene was present in 45 4 per cent of all strangulated obstructions and in 17 per cent of series

disease in which both the afferent and the efferent loops are blocked With the exception of large bowel obstruction in the presence of a competent ileocecal valve, closed loop obstruction without strangulation is rare Closed loop obstructions even without strangulation as in the colon, are particularly hazardous because of the likelihood of perforation and respiratory and circulatory dysfunction due to abdominal distention

The most common causes (65 per cent) of mechanical obstruction in the aged lie outside the bowel Examples of such extrinsic obstructions are the neck of a hernial sac adhesive bands and torsion of the bowel Occurring less frequently (33 per cent) are obstructions resulting from intramural lesions such as carcinoma hemorrhage or inflammatory strictures Occasionally (2 per cent), intraluminal or obturator obstructions occur owing to the plugging of either physiologic or pathologic sites of narrowing in the bowel by foreign bodies gall stones impacted feces or parasites

TABLE 18 7 ETIOLOGIC INCIDENCE AND MORTALITY ACUTE MECHANICAL INTESTINAL OBSTRUCTION IN PATIENTS 65 YEARS OF AGE AND OLDER *

	No of patients	Etiologic incidence %	No of deaths	Mortality %
External hernia	53	26 5	1	1 [illegible]
Adhesion	4[illegible]	1 0	3	7
Neoplasms	41	20 5	13	31 8
Diverticulitis	16	8 0	1	6 3
Volvulus	13	6 5	4	30 8
Mesenteric occlusion	11	5 5	10	91 0
Stricture	9	4 5	1	11 1
Internal hernia	6	3 0	0	0
Obturation	6	3 0	1	16 7
Miscellaneous	3	1 5	1	33 3
Total	200	100 0	35	17 5

* The New York Hospital Cornell Medical Center 1944 1957

The more common classification of intestinal obstructions by etiologic diseases is useful since it may demonstrate the changing incidences of diseases the influence of etiology on mortality and the relative frequency of the underlying causes (Tables 18 7 18 8 and 18 9) Hernias adhesions and carcinomas in nearly equal proportions cause 70 per cent of the intestinal obstructions in the aged

In the author s experience external hernia is the most common cause of intestinal obstruction in the aged Hernias that result in intestinal obstruction are generally considered strangulated whether or not actual gangrene is present Those with comparatively small rings result in strangulation obstructions much more often than those with larger diameters Whereas a loop of bowel may

enter and return through a larger ring fairly easily this is much more difficult when the hernial orifice is less than 2 in in diameter Failure to return causes strangulation of the loop of bowel involved

Since the inguinal area is the most common site of hernia it is also most frequently the place where a loop of bowel becomes trapped within the hernial sac However femoral hernias although comprising only 2 per cent of all hernias may account for over a quarter of the strangulated hernias in the aged and in the elderly afflict men and women equally Less commonly umbilical and ventral hernias may cause strangulation When an umbilical hernia is associated with ascites strangulation is notoriously apt to develop shortly after abdominal paracentesis Only rarely do strangulated obturator and sciatic foraminal hernias occur and they are limited almost solely to cachectic elderly persons These hernias usually go unrecognized until laparotomy although they may produce characteristic symptoms and findings (see Chap 19) In the vast majority

TABLE 18 8 SMALL BOWEL OBSTRUCTION IN PATIENTS 65 YEARS OF AGE AND OLDER *

	No of patients †	*No of deaths* ‡	*Mortality %*
Inguinal hernia	23	1	4 4
Femoral hernia	15	0	0
Umbilical hernia	5	0	0
Ventral hernia	4	0	0
Adhesions	41	3	7 3
Mesenteric occlusion	11	10	91 0
Volvulus	9	3	33 3
Neoplasms	8	3	37 8
Internal hernia	6	0	0
Obturation	4	1	25 0
Stricture	4	0	0
Total	130	21	16 1

*The New York Hospital-Cornell Medical Center 1944–1957

† Small bowel obstruction was responsible for 65 per cent of acute obstruction in the aged

‡ Small bowel obstruction was responsible for 60 per cent of deaths in aged patients with acute obstructions

TABLE 18 9 LARGE BOWEL OBSTRUCTION IN PATIENTS 65 YEARS OF AGE AND OLDER *

	No of patients †		*No of deaths* ‡		*Mortality %*
Carcinoma	33		10		33 0
Left colon		*27*		*8*	29 6
Right colon		*6*		*2*	32 4
Diverticulitis	16		1		6 3
Volvulus	4		1		25 0
Stricture	5		1		20 0
External hernia	6		0		0
Adhesions	1		0		0
Obturation	2		0		0
Miscellaneous	3		1		0
Total	70		14		20 0

*The New York Hospital-Cornell Medical Center 1944–1957

† Large bowel obstruction was responsible for 35 per cent of acute obstructions in the aged

‡ Large bowel obstruction was responsible for 40 per cent of deaths in aged patients with acute obstructions

of strangulated hernias it is the small bowel that is entrapped With the exception of Richter s type of femoral hernia strangulated hernias are recognized promptly by patients and surgeons and consequently have a low mortality since they are treated early In recent years decline in the incidence of strangulated hernia especially strangulated femoral hernias has been noted and is doubtless the result of surgical correction at an earlier age

Adhesions the leading cause of all intestinal obstructions is the second major cause of obstruction in the aged Adhesive obstructions almost categorically involve the small bowel and their presence is nearly always traceable to a previous abdominal operation

There are several mechanisms by which adhesions obstruct the lumen of the small intestine An adhesion may be found between two loops of bowel or between a loop of bowel and some fixed point on the parietal peritoneum or occasionally a loop of small bowel may slip between the adhesive band and a fixed point and produce an intestinal hernia Obstruction occurs immediately if the bowel is tightly enclosed and a closed

loop obstruction usually follows promptly However there are two possibilities when the opening created by the adhesive band is larger and allows for greater movement If the outflow from the loop is retarded the *loop becomes* distended and then totally occluded Distention and edema of the wall of the bowel involved, however, may soon lead to complete closure at the site of the obstructing adhesion

The second possible event is volvulus of the loop trapped by the adhesive band *through 180 or 360° or even a greater de*gree of rotation The twist is usually caused by off center accumulations of fluid which favor rotation upon the mesenteric axis of the loop in response to gravitational forces

Carcinoma as expected is one of the three principal causes of intestinal obstruction in the aged and has a high rate of mortality even though the deaths from carcinomatosis are overlooked Since carcinoma of the intestines occurs far more commonly in the large bowel it is the chief cause of *colonic obstructions Carcinoma of the left* colon is more likely to produce intestinal obstruction because of its prevalence and stenosing nature in this location Whereas carcinoma accounts for 80 per cent of all large bowel *obstructions in the aged it is* responsible for only about half of such obstructions because other age linked disease, such as diverticulitis appear The *incidence* of intestinal obstruction due to carcinoma in *the aged has increased in recent years cor*responding to the decline in obstruction due to hernias

The fourth leading cause of intestinal obstruction in the elderly is diverticulitis usually *involving* the *sigmoid colon Diverticuli*tis typically produces chronic intestinal obstruction however only those cases in which the obstruction was acute are included in the author s figures Patients with this disease *usually seek medical* treatment long before acute obstruction develops Should those with symptoms of only partial obstruction be included its incidence would rise sharply *perhaps tripling*

The seriousness of volvulus and mesenteric occlusion is exhibited by the fact that although each caused only about 6 per cent of the acute bowel obstructions they were responsible for 40 per cent of all the deaths Primary volvulus of the small intestine is rare in adults although it is common among *certain African and Indian peoples who con*sume a farinaceous vegetarian diet Because it is misdiagnosed or unrecognized an especially lethal primary small bowel volvulus may occur in aged patients with thin and *mobile mesenteries if the small bowel is in*correctly *replaced in the abdomen during* a laparotomy Most volvuli of the small intestine occur secondary to an adhesion on the antimesenteric portion of the bowel which provides an axis around which the volvulus may occur

In the colon however *primary* volvulus is the rule and occurs chiefly in the cecum and sigmoid The cecum must be unattached or mobile for volvulus to occur in this segment of bowel With the exception of chil*dren with megacolon* sigmoid volvulus predominates in the elderly It peculiarly affects senile older men in whom it is frequently apt to be chronic It is especially important that sigmoid volvulus be considered in all *aged patients with* large bowel obstruction since failure to recognize its presence has commonly resulted in mistreatment of this condition

In mesenteric occlusion blockage of either the artery or the vein or both may initiate the strangulation The majority of mesenteric artery occlusions are the result of emboli arising from mural thrombi in the left atrium in patients with chronic cardiac disease and auricular fibrillation Spontaneous thrombosis of this artery is rare in the absence of some primary vascular disease such as Buerger s disease or an *antecedent epi*sode of hypotension Pure arteriosclerotic or atherosclerotic mesenteric artery occlusion occurs rarely if ever Thrombosis of the mesenteric vein may begin in the portal vein *in patients with cirrhosis* Other conditions that may cause such thromboses are shock

systemic infection peritonitis intraabdominal abscesses and inflammatory processes and tumors

The mortality rate in mesenteric occlusion is extraordinarily high owing to the facts that irreversible extensive gangrene is already present by the time of operation and that the aged patient does not tolerate the severe nutritional handicap imposed by extensive bowel resection Earlier recognition and prompt embolectomy to prevent extensive bowel resection may reduce its mortality and morbidity

The less common causes of intestinal obstruction are internal hernia obturation and benign strictures Occasionally congenital malformations of the intestines usually Meckel s diverticulum are discovered to be the offenders The intraabdominal sites entrapping a loop of bowel usually result from adhesive bands and surgically created defects Bowel may also slip into any of the normally present peritoneal foramina or fossae

Gallstone ileus once one of the most common forms of obturation obstruction in the aged occurs only rarely now because cholecystectomy is performed before serious complications of gallbladder disease develop Obturation is more apt to occur in the bowel at sites of physiologic or pathologic kinking and reduced diameters Thus the terminal ileum the sigmoid and the jejunum at the ligament of Treitz in that order are the frequent sites of foreign body impingement Obturator obstructions are characterized by intermittent episodes of obstruction as the gallstone fruit pit or other offending agent becomes recurrently held up during its intestinal passage Altogether too frequently does barium sulfate combined with the cathartics and enemas used to promote its evacuation convert a partial obstruction to the complete type

Radiation therapy for carcinoma of the cervix in the author s experience was responsible for the majority of bowel occlusions due to strictures in the aged The terminal ileum rectum and sigmoid are the common sites of such obstruction Other inflammatory diseases such as regional enteritis and ulcerative colitis as well as poorly constructed intestinal anastomoses may produce strictured obstructions Anastomotic occlusions in this series of elderly patients were responsible for the bulk of postoperative bowel occlusions and these occurred mainly at the site of colostomy closures regardless of the technique used

PATHOPHYSIOLOGY OF INTESTINAL OBSTRUCTION

The pathophysiologic consequences of mechanical obstruction depend on the site rate and degree of obstruction presence or absence of strangulation length of the strangulated loop of bowel and the specific type of obstruction

Simple Obstruction

The primary response to simple mechanical obstruction is a great increase in peristaltic activity provoked by the dammed up intestinal contents This is especially evident in the segment of bowel just proximal to the occlusion The heightened peristaltic activity in response to increased intraluminal tension is followed by more violent and uncoordinated contractions and by waves of reversed peristalsis The increased peristalsis may produce a normal bowel movement which is often seen early in the ailment but it may also produce the frequent small movements encountered in partial obstruction A possible consequence of prolonged increased peristalsis as in partial obstruction is hypertrophy of the bowel wall After the distal bowel has been evacuated of its contents it contracts and remains empty and quiet

Edema of the bowel wall develops quickly at the site of occlusion and may convert a partial obstruction into a complete one or ensure incarceration of bowel trapped in a hernia sac At first this edema results from the traumatizing effects of the vigorous peristalsis but later it is the result of local circulatory changes in the bowel wall associated

with distention The fact that some obstructions are relieved by intestinal decompression alone illustrates the significant role that local edema plays in intestinal obstruction

Soon the bowel dilates since intraenteric pressures continue to rise as gastrointestinal secretions, ingested food and fluid and swallowed air accumulate Distention and increased intraluminal tension are the most *important pathophysiologic alterations in* simple occlusions since they are responsible for a series of pernicious and self perpetuating events Although distention is most prominent just above the occlusion it may, if unrelieved, involve the whole proximal bowel Then the laden loops of bowel may kink and produce multiple points of occlusion Severe intestinal distention besides adversely affecting the bowel increases intraabdominal tension Respiratory and circulatory dysfunction follow and favorable circumstances for the development of thrombophlebitis are developed by compression of the inferior vena cava

As the bowel fills its power to absorb digestive products (fluid and gas) is diminished and the quantity of fluid secreted into the digestive tract is actually increased Additional fluid transudes from the capillaries of the bowel This transudate magnifies the fluid losses intensifies edema of the bowel and mesentery and produces ascites and weeping of the intestinal mucosa These effects stem from early compression of the venous side of the local circulation which takes place rather soon after obstruction occurs

Along with fluids several gases also accumulate in the bowel The main source of gas is swallowed air (70 per cent) Gas however is also derived from bacterial fermentation and putrefaction processes (10 per cent) and from the diffusion of gas into the lumen from congested mucosal capillaries (20 per cent) Early in the course of the obstruction gas in the distended bowel is similar in composition to atmospheric air As time passes the oxygen content diminishes the carbon dioxide increases and other gases principally hydrogen sulfide accumulate

Meanwhile, the intestinal contents stagnate Not only do bacteria proliferate but they undergo a change proteolytic and Gram negative organisms outgrow other varieties The intestinal contents in the small bowel become flaky, thin and brown In the large bowel feces are usually liquid

Generally the degree of intraenteric pressure varies directly with the duration of obstruction The greater length of the small bowel and the decompression induced by vomiting prevents intraluminal pressures in that part of the gut from becoming very high unless a closed loop obstruction is present Measurements in patients with small bowel obstruction have shown pressure to range from 4 to 14 cm of water However temporary pressures of 20 to 30 cm of water may occur in the obstructed bowel during peristalsis

In the obstructed colon however, pressures usually rise to much higher levels the range varying from 12 to 52 cm and averaging 23 cm of water The high pressures are attained because a closed loop is created by the competent ileocecal valve at the proximal end and the obstructing agent at the other The pressures of 50 to 75 cm of water required to open a normal ileocecal valve are far higher than the intracolic pressures in large bowel obstructions

The effects of distention on the bowel are increased diameter shortened length and thinning of the wall (often masked by edema) When gross stretching of the intestinal muscle occurs there is inhibition of peristalsis Thereafter the bowel passively dilates Diminished blood supply and enzymatic and electrolyte (hypokalemia) imbalance may also induce intestinal paresis

Although the small vessels entering the bowel wall from the mesentery are arranged so as to minimize any circulatory disturbances that might arise from normal peristalsis or distention they may nevertheless be adversely affected if distention is severe Venous and then arterial stasis not only pro

duce edema but are followed by reduced blood flow anoxia bacterial and leukocytic invasion and ischemic necrosis of the bowel wall This occurs despite the fact that actual obliteration of the mesenteric arterioles re quires pressures greater than those which occur clinically since sustained low pressures have been shown to produce intramural vascular compression Hemorrhage into the bowel or mesentery may follow and as the involved segment s blood supply vanishes gangrene makes its appearance and is suc ceeded by perforation peritonitis and death Thus if unattended simple mechanical intestinal obstruction becomes a strangulation obstruction

In the author s series of aged patients the incidence of rupture of the bowel in simple obstruction was 2 per cent (Table 18 6) In addition 3 3 per cent of the large bowel and 3 6 per cent of the small bowel ob structions perforated This is slightly higher than the incidence of perforation in the all age group and probably reflects a variety of factors in addition to intrinsic intestinal and circulatory changes associated with old age As pointed out above sustained intraluminal pressure acts with anoxia and edema to weaken the bowel wall and to increase the chances of rupture Because of its less rich blood supply greater diameter and very thin wall when dilated the cecum is espe cially likely to perforate when the large bowel is obstructed

Strangulation Obstruction

Strangulation obstruction is clearly the most serious form in terms of the patho physiologic damage done because there is interference with the mesenteric vessels serv ing the involved bowel Though infarction in other organs can be tolerated for relatively longer periods deprivation of the blood sup ply to the bowel triggers a series of events which rapidly culminate in death The oc cluded blood supply results in necrosis of the bowel then in perforation and in peritonitis In nearly all strangulated obstruction oc clusion of the lumen of the bowel usually precedes the occlusion of the blood supply Nevertheless the ischemic segment because of intestinal paresis represents an area of obstruction since even if the lumen is pat ent the intestinal contents cannot pass through it

Loss of blood is a characteristic and sig nificant feature in strangulated obstruction Most strangulation begins as venous occlu sion and the bowel rapidly becomes engorged with blood Blood fills the lumen of bowel and there is hemorrhage into the mes entery The peritoneal fluid is bloodstained whereas in simple obstruction it is clear

Even when the mesenteric artery is oc cluded there is hemorrhagic infarction After transient pallor and anemia the bowel be comes cyanotic and then black since its capillaries stagnate with blood from collat eral circulation and from the backflow of blood from the valveless portal and mesen teric veins When more than just a small segment of bowel is involved this loss of blood may be enough to result in surgical shock

Strangulated bowel becomes rapidly in fected since the lumen contains many viru lent bacteria The necrotic bowel is in fact an area of wet gangrene The detrimental in fluence of bacterial invasion and the ab sorption by the peritoneum of bacterial tox ins have been convincingly demonstrated in experimental strangulated obstruction

Many investigators have blamed *Clostrid ium welchii* for the lethal substances en countered in intestinal obstruction However other organisms may also flourish and it is doubtful whether any single one may be incriminated Nevertheless antimicrobial agents have prolonged life in experimental strangulated obstruction Their beneficial role in simple obstruction and obstruction of any kind in man has not been definitely established except when peritonitis or peri toneal soiling has occurred The abnormal permeability of strangulated bowel has sug gested the incrimination of other toxic sub stances as the cause of rapid death in stran gulation These have been related to break-

down products of hemoglobin and autolytic products of the intestinal wall

That transperitoneal absorption of toxins or transperitoneal bacterial invasion is important in man is demonstrated by several facts A strangulated loop of bowel caught in a hernial sac results in less toxemia than if it were free in the peritoneal cavity and therefore exposed to greater surface Similarly rapid improvement is usually observed in patients when the dead bowel is merely lifted from its peritoneal environment

Fluid and Electrolyte Depletion

The extent of the fluid loss bears strongly upon the outcome of any case of intestinal obstruction The water and electrolyte losses of course depend on the site and duration of the occlusion In the patient with intestinal obstruction the changes in water and electrolyte balance and plasma and blood volume are not serious in the first few hours after onset However as time passes or if the involved gut becomes strangulated these changes may by themselves lead to the patient s death

Normally the adult gastrointestinal tract secretes 8 200 ml of fluid daily of which all but 100 to 200 ml of water is reabsorbed by the ileum and right colon This consists of 1 500 ml of saliva 2 500 ml of gastric juice 500 ml of bile 700 ml of pancreatic juice and 300 ml of intestinal juice Besides enzymes these secretions contain sodium potassium chloride and bicarbonate the ionic concentration of these is variable

Saliva is very hypotonic and contains only about 9 mEq of sodium per liter but may have as much as 25 mEq of potassium per liter Since it is nearly pure hydrochloric acid gastric juice contains 150 mEq of chloride per liter It must be remembered however that elderly patients often have gastric achlorhydria Whereas the sodium content of gastric juice is very low potassium concentrations are high varying from 10 to 25 mEq per liter or more The ionic concentration of the intestinal pancreatic and biliary secretions are nearly isotonic with plasma and have comparable sodium concentrations Their potassium content however which is over twice that in the serum is usually about 10 mEq per liter

Thus the patient who vomits during intestinal obstruction and has secretions pooled in his bowel is dehydrated and the water deficit may be as great as 10 per cent of body weight In addition there is hyponatremia and hypochloremia Generally sodium loss exceeds chloride loss Metabolic acidosis results and this is intensified by ketosis due to starvation and the retention of organic acids as a result of diminished renal blood flow Although the intracellular sodium concentration may vary, there is usually always a decrease in the cellular potassium since it is lost in the gastrointestinal secretion The fact that potassium deficiency produces alkalosis occasionally counteracts the tendency to acidosis

Whole blood loss is encountered only when the obstruction has strangulated Nevertheless considerable reduction in effective circulating blood volume may occur in simple obstruction because of congestion and pooling in the mesentery Actual plasma loss exists in all types of intestinal obstruction because of transudation and exudation by the bowel Hypoproteinemia may therefore develop

A high intestinal occlusion which fortunately is rare leads to a rapid loss of water and electrolytes since the jejunum absorbs little of these materials The loss of 5 000 to 7 000 ml of secretion in a day in this type of obstruction plus the lack of normal daily intake quickly upsets physiologic balance Death occurs after but a few days of such uninhibited fluid and salt loss

Because of its greater absorptive surface obstruction low in the small bowel leads more slowly but nevertheless inexorably to serious depletions In contrast however left colon obstruction results in virtually no disturbance in hydration and electrolyte balance since water electrolytes and digestive products are normally absorbed by the ileum and right colon

CLINICAL FEATURES OF INTESTINAL OBSTRUCTION

While diagnosis of acute intestinal obstruction is usually simple there are times when it becomes extremely difficult The cardinal signs and symptoms of pain, obstipation vomiting, and distention are familiar but in too many instances the diagnosis is not made rapidly enough to save the patient One reason for the delay is that the attending physician loses sight of the fact that there is no need to wait for all four of the cardinal features to appear, the appearance of only one may be sufficient to confirm the presence of acute intestinal obstruction Another reason is the tendency to misinterpret the patient s complaints and findings This is caused by failure to take special cognizance of the biologic changes of old age which result in elderly patients reacting less violently in all ways to the injurious effects of intestinal obstruction Rarely do aged patients unless obtunded fail to seek medical aid after the onset of intestinal obstruction Providing the symptoms and signs are interpreted with due regard for the condition and age of the patient a correct diagnosis may be made in sufficient time to prevent irreparable damage

Pain is the earliest and most important symptom of acute mechanical intestinal obstruction Usually it is so intense that morphine can do no more than dull it If the involved bowel segment is not strangulated the pain is crampy or colicky quickly reaches peak severity and persists for 15 to 30 seconds It occurs in waves appearing every 2 to 3 minutes The vigorous peristaltic rushes which cause this pain are easily heard and are sometimes visible if the abdominal wall is thin By auscultation they sound like high pitched metallic gurgling or bubbling explosions which are loudest near the point of occlusion

Early in the condition the patient may be entirely comfortable between the waves of pain but regularly and almost rhythmically he will grimace and clutch at his abdomen as it reappears In aged patients peristalsis fatigues early in the course of the ailment and often before significant bowel dilation occurs When this takes place, the colicky pain may subside More often however the severe crampy pain is replaced by a constant feeling of abdominal distention and generalized discomfort Although this change in the nature of the pain may only represent intestinal paresis it may also indicate peritoneal irritation and herald approaching necrosis of the obstructed bowel

The location of the pain often indicates the side of the obstruction Typically small intestinal colic is referred to the epigastrium and colonic pains to the lower abdomen Sometimes the pain may be accurately pin-pointed by the patient himself if he is asked to place his hand where he feels the most pain It must be recognized however that there are variations in the nature and location of the pain and that generalized abdominal cramps as well as back pain may be caused by obstruction in either the small or large bowel

The patient with an obstructed colon may feel pain at any point along the distended bowel but especially over a distended cecum However colicky pains are commonly absent or so mild as to go unrecognized in large bowel obstructions which have developed gradually in the presence of a competent ileocecal valve Obstructing lesions in the rectum and sigmoid occasionally produce perineal pain which may even be crampy

Strangulated obstructions characteristically produce an unrelenting severe pain which is commonly referred to the back and rapidly intensifies as gangrene develops The localization and severity of the pain depend on the site the degree of vascular occlusion and the length of the bowel involved Severe local pain may also indicate peritonitis The development of a steady pain after a period of colic indicates that a simple obstruction has become a strangulated one

Since peritoneal irritation occurs early in strangulated obstruction severe pain may be

present constantly almost from the start Colicky pains need not be present and are typically absent when gangrene develops quickly, as in cases of mesenteric occlusion Consequently intestinal obstruction must be seriously considered in all cases of acute abdominal pain However, reliance on the character of pain as an indication of strangulation in aged patients is extremely hazardous

Pain is accompanied by abdominal tenderness guarding and rigidity Guarding and rigidity of the abdominal wall frequently are minimal in elderly individuals because of weak abdominal parietes Simple obstructions usually do not cause tenderness unless gross intestinal dilation is present and even then the tenderness may be so minimal as to be difficult to elicit Strangulated obstruction frequently causes both direct and indirect tenderness rebound tenderness and spasm of the overlying abdominal muscles Sometimes a mass representing the involved bowel is palpable Nevertheless, such findings are not uncommonly absent early in the course of a strangulated obstruction For instance a soft and doughlike abdomen in the presence of severe pain is characteristic of mesenteric artery occlusion prior to the development of irreparable gangrene The absence of abdominal findings may lead the surgeon to a fatal delay in diagnosis and treatment of patients with strangulated obstruction

With respect to abdominal palpation inspection of the common and rare hernial orifices must never be omitted Femoral hernias in obese individuals may be easily over looked Also an incarcerated hernia irreducible because of abdominal distention, should not be mistaken for the primary pathology merely because of its presence or the patient s concern with it Lastly careful palpation provided that abdominal distention and muscle spasm are not marked may reveal a tumor or inflammatory mass

Although pain is an important characteristic of intestinal obstruction there are circumstances under which it may be absent Among such circumstances are (1) the early postoperative period in a narcotized and therefore relatively pain free patient who evidences nausea or distention and partial obstruction and (2) upper jejunal occlusion due to tumors or adhesions since vomiting decompresses the short obstructed segment of intestine

Obstipation a classical feature in all examples of complete intestinal obstruction is not necessarily a reliable early symptom since flatus and feces may be passed until the bowel distal to the obstruction has been evacuated Enemas administered then return clear and without gas Rectal pelvic and sometimes sigmoidoscopic examinations are essential in evaluating obstipation

Little reliance should be placed on the patient s statement of his last bowel action since elderly patients although quite aware of their bowel movements, are prone to chronic constipation However the failure to pass flatus is a significant indication of intestinal obstruction since it is an unforgettable occurrence in the aged

Whereas the time of the patient s last bowel movement is unimportant the nature of the stool is important since it may provide a clue to the type and cause of the intestinal obstruction Stools containing blood may occur in mesenteric occlusion volvulus intussusception and carcinoma Loose watery stools are evidence of partial obstruction

Diarrhea paradoxically accompanies partial intestinal obstruction Partial occlusion of the bowel allows only liquid feces and gas to pass These are then rapidly moved along by the heightened peristalsis Thus diarrhea is sometimes the first indication of an impending acute obstruction Localized mild crampy pain occurring simultaneously with borborygmus mild distention and localized tenderness but rarely vomiting are the clinical features of partial obstruction of the intestine. Partial intestinal obstruction preceding a complete bowel occlusion is most likely to occur in the colon or distal ileum as a result of tumors strictures and inflam

matory processes of the bowel or adjacent structures Low lying sigmoidal or rectal obstruction lesions often cause diarrhea with a sense of defecatory urgency which is sustained without relief Either carcinoma or diverticulitis is almost always the cause of these lesions These are therefore likely to be bulky and edematous hence the feeling of rectal fullness and the desire to defecate

Vomiting is a fairly reliable although not invariable symptom of intestinal obstruction Important information as to the site of the obstruction may be gleaned by noting the frequency of vomiting and the nature of the vomitus In general vomiting is less marked in the elderly chiefly because of less vigorous and rapidly tiring peristalsis

When the obstruction is in the small intestine reflex vomiting occurs at the outset It may be profuse and forceful and is often associated with retching and painful abdominal muscles later A period of relative freedom follows the initial siege of vomiting after which small bowel contents start to make their appearance in the vomitus If large quantities of clear bile are in the regurgitated contents the occlusion has occurred near the ligament of Treitz Feculent vomitus indicates an obstruction at or below the level of the midjejunum Successful decompression of the distended bowel by nasogastric suction generally controls the vomiting and prevents the possibility of aspiration

In acute obstructions of the colon vomiting is usually a latent symptom mainly because small bowel distention and increased peristaltic activity also are late sequelae Fecal vomiting may never take place if the ileocecal valve is competent However when the colonic obstruction is strangulated vomiting often is an early symptom In these instances the abdominal pain may be so intense at onset as to induce vomiting on a reflex basis

While fecal vomiting is a very significant symptom of acute intestinal obstruction its absence should not rule out this diagnosis This is particularly pertinent to lesions of the colon Vomiting also may be commonly absent in strangulated obstructions of the small bowel

Nor should feculent vomiting be assumed to establish the diagnosis of mechanical intestinal obstruction, since it can follow paralytic ileus Moreover feculent vomiting in the absence of ileus may be due to a gastrocolic fistula coprophagy or violent reverse peristalsis owing to a central nervous system lesion influencing peristaltic activity

Distention is a prominent symptom of intestinal obstruction although it develops late in the course of the disease Distention occurs proximal to the site of occlusion as gas and fluid accumulate within the intestinal tract There is much less distention in small bowel obstruction than when the colon is involved It may even be clinically inapparent in some patients if the small segment of bowel proximal to the point of obstruction is satisfactorily decompressed by periodic vomiting

Generally the lower the site of obstruction the greater the distention When the colon is obstructed there may be very considerable distention often in the periphery of the abdomen When late obstruction of the lower colon is combined with an incompetent ileocecal valve massive symmetrical distention involving the entire peritoneal cavity may occur Should this valve be competent and the abdominal wall thin the outline of a greatly distended colon may even be discerned A large visible distended loop may be the result of volvulus of the sigmoid Patients with pronounced distention of the abdomen are often dyspneic and slightly cyanotic and may have slightly elevated venous pressure in the lower extremities

Fever and leukocytosis occur in mechanical obstruction and may be the result of dehydration alone Knowledge of the status of fluid and electrolyte replacement is important in evaluating the significance of any fever and leukocytosis found If present at all in simple obstruction the fever is mild and if perforation is not impending temperature may be normal or even subnormal

White blood cell counts also tend to be normal in early obstructions

When there is a strangulation, fever ranging between 37 5 and 39 5°C may develop within 6 to 12 hours after symptoms first appear More typical of this state is a moderately high white blood cell count 15 000 to 25 000 for example along with polymorphonuclear leukocytosis Fever and leukocytosis of these magnitudes soon after onset of the underlying obstruction constitute strong evidence of the existence of a strangulation White blood cell counts in the 30 000 to 50 000 range developing early, strongly suggest mesenteric thrombosis

Fever and leukocytosis developing after 2 or 3 days in simple obstructions must be taken as a warning of impending perforation of the bowel wall or focal necrosis This means that no delay of operative intervention can be justified

As with pain and distention it must be stressed that fever and leukocytosis are no more than general trends and, as such are not reliable guides either to the diagnosis of obstruction or to the differentiation of simple and strangulating varieties On more than one occasion a normal leukocyte count and an essentially normal differential count have been found to accompany a strangulated obstruction

Other clinical features are variable and are chiefly those due to dehydration toxemia and blood loss Since the features of these secondary effects are nonspecific and are elaborated in detail elsewhere in this book, a detailed description of them will not be repeated Suffice it to say that the patient may exhibit extreme thirst dry loose skin, coated shrivelled tongue foul breath sunken and soft eyeballs oliguria a rapid and thready pulse, hypotension and shock or peripheral vascular failure

Laboratory findings show hemoconcentration which may mask anemia and hypoproteinemia Serum sodium and chloride concentration are depressed The carbon dioxide combining power is usually low while serum potassium levels are either normal or elevated Elevation of the serum urea nitrogen and nonprotein nitrogen are regularly found

Radiologic examination is by far the most important procedure in making the diagnosis of intestinal obstruction The roentgenographic studies help establish the presence or absence of acute mechanical obstructions, intraabdominal masses or fluid and also may define the site of occlusion Though as many as 90 per cent of cases can be diagnosed in this manner, the surgeon must recognize its limitations and therefore must avoid strict reliance upon it Nevertheless the absence of pathologic findings in the radiologic studies must not detract from the clinical diagnosis, especially when the obstruction has been diagnosed to be of the closed loop or strangulated type Also, while the diagnosis of obstruction may be made, the localization may be inaccurate If for example a great deal of fluid collects above the occlusion pushing of the gas proximally may lead the observer to believe that the obstruction is much higher than it really is

Strong indications that a patient has an obstruction call for insertion of the appropriate tube for decompression and aspiration of the stomach before obtaining diagnostic radiologic studies Use of a long intestinal tube makes it possible to perform fluoroscopic manipulation at the time of the original examination

To obtain the greatest information from the radiologic examination films of the abdomen should be taken with the patient both supine and erect In addition lateral decubital views obtained by directing the x ray beam horizontally at the side of the abdomen are helpful Films taken in these positions will be more likely to reveal evidences of fluid levels bowel wall edema and in the case of perforation of the bowel, free peritoneal air

Centrally located and regular and transversely arranged air filled loops of small bowel showing fluid levels are the typical radiologic findings of small bowel obstruction (Fig 18 1) Radiologic evidence of small bowel obstruction is usually present

within 6 hours of its onset Nevertheless, such radiographic findings may also be found in patients with paralytic ileus

Films in patients with paralytic ileus usually show an olio or hotchpotch of gas distending not only the small bowel but the stomach and colon as well The loops of bowel often do not appear active or dynamic although a stepladder picture is common Usually the diagnosis must be established on clinical grounds remembering however that the radiographic picture of paralytic ileus may exist in some mechanical obstruction (Fig 18 2)

Closed loop small bowel obstructions are sometimes manifested by a persistent single loop of dilated bowel which resembles a coffee bean and ends in a bird s beak or ace of spades defect and may be accompanied by a notable absence of gas and fluid in the bowel elsewhere (Fig 18-3) On the other hand the only characteristic of a closed loop obstruction may be distended proximal loops of bowel the occluded loop being virtually filled with fluid and free of bubbles In this instance a mass representing the strangulated bowel may be seen displacing the adjacent dilated bowel Occasionally roentgenograms may be entirely unrevealing in patients with strangulated obstructions Notable in this instance is mesenteric occlusion (Fig 18 2)



Fig 18 2 Radiographic study showing paralytic ileus Although the loops occur regularly they appear inactive Gas is seen elsewhere in the bowel and most significantly in the colon Actually this patient 67 years old had mesenteric occlusion Occasionally the limits of the ileus are clearly seen in this condition



Fig 18 1 Plain abdominal radiographic film showing typical findings in simple mid small bowel obstruction Note the regular and dynamic appearing stepladderlike loops of distended bowel Edema of the bowel wall and excess peritoneal fluid are evident Such a condition usually requires 24 hours or more to develop In an upright film air fluid levels would be visible

Obstruction of the colon takes longer to produce characteristic radiologic findings The obstructed large bowel is usually easily recognized by its peripheral location greater dilation and the absence of plicae circularis although haustral indentations are frequently noted (Figs 18-4 and 18 5) If there is a blow back of the air into the small bowel the dilated colon may be obscured and may even be mistaken for paralytic ileus Volvulus of the cecum as well as simple occlusion



Fig 18 3 This roentgenogram shows the characteristic coffee bean appearance sometimes manifested by the involved bowel in strangulated obstruction Clearly apparent are the ace of spades or bird s beak ends of the loop

of the ascending colon frequently produce the sole finding of a huge circular or oval pocket of air representing the gas filled cecum (Fig 18 6) Volvulus of the sigmoid (Fig 18 7) commonly results in a single enormously dilated loop of bowel which like closed loop obstruction elsewhere, may terminate with the ace of spades defect but cease to be typical when this condition is chronic or the proximal colon is dilated

In aged patients with colonic obstruction it is particularly desirable to conduct a barium enema examination provided no evidence of any kind has been unearthed to suggest actual or impending perforation This procedure clearly locates the point of obstruction in the colon and often defines its nature Thus operation may be avoided in those patients with colonic paralytic ileus a condition which especially afflicts the elderly Similarly, the catastrophe of performing a transverse colostomy in the proximal dilated colon in patients with sigmoid volvulus may be averted A cardinal rule where colon obstruction is suspected is never to administer barium sulfate by mouth because it may become inspissated and often converts an incomplete colon or even a low small bowel obstruction to a complete one

Finally, the surgeon must try to acquire the maximum amount of information from the simplest examinations He must make certain that all procedures are carried out as expeditiously as possible In the interest of early surgical intervention it is often necessary to forego thorough radiologic studies

Differential Diagnosis of Intestinal Obstruction

The presence of intermittent crampy abdominal pain vomiting and distention usually indicates an acute mechanical obstruction The diagnosis based on these signs and symptoms may be confirmed by roentgenographic films showing distended loops of small or large bowel and the impass of contrast medium in the case of large bowel ob



Fig 18 4 Left colon obstruction due to carcinoma This bulky tumor is unmistakably identified by the outline of the tip of the barium sulfate column The large loop in the central portion of the film could easily be mistaken for sigmoid but is actually transverse colon

struction However despite the apparent ease with which the diagnosis should be made difficulties are encountered in practice Noteworthy in this connection is the fact that some types of obstruction may progress to other types as time passes For example a paralytic ileus may become a mechanical obstruction and a simple mechanical obstruction can turn into a strangulated obstruction Finally aside from determining the type of obstruction the surgeon should also resolve the cause site, and degree of obstruction if he is to obtain the best therapeutic result

Simple mechanical obstruction may be confused with many diseases primarily acute gastroenteritis pancreatitis appendicitis and renal or biliary colic Similarly a strangulated obstruction may imitate any one of a number of diseases marked by the combination of peritonitis and ileus The most common ones are pancreatitis appendicitis and perforated duodenal ulcer It may also be



Fig 18 5 Right colon obstruction due to carcinoma of the hepatic flexure in a man 67 years old There is immense dilation of the cecum Three years previously the man had an obstructive carcinoma of the sigmoid The lesion was irremovable it was treated first by cecostomy followed shortly thereafter by ileotransverse colostomy



Fig 18 6 An excellent illustration of volvulus of the cecum Barium fills the distal end of the twisted bowel The cecum is immense and characteristically extends obliquely across the abdomen

mistaken for myocardial infarction Generally the correct diagnosis may be made by the clinical history physical findings, and laboratory test

Although serum amylase elevations and bilirubinemia usually help to differentiate acute biliary tract and pancreatic disease from intestinal obstruction they cannot necessarily be relied upon to do so An elevated serum amylase due to edema of the duodenal mucosa and sphincter of Oddi is often present in patients with intestinal obstruction An elevated serum bilirubin is found occasionally under similar circumstances but may be due to hemolysis if there is strangulation

Acute gastroenteritis in its early phase may be difficult to distinguish from obstruction Moreover the increased peristalsis of gastroenteritis may precipitate intussusception or simple obstruction if adhesions are present Diarrhea serves as the chief distinguishing feature in gastroenteritis

Acute urinary tract infection commonly



A B

Fig 18 7 *A* Volvulus of the sigmoid The huge looped bowel on the left represents the twisted and dilated sigmoid Its mottled appearance results from feces within it The marked distention of the proximal colon may lead to an erroneous diagnosis of simple large bowel obstruction *B* Barium enema examination in this typical case of sigmoid *volvulus produces a picture which remarkably resembles a bird s beak*

accompanied by paralytic ileus may be recognized by finding pyuria or dysuria In obstructive uropathies these findings are often absent in which instance pyelography and a barium enema examination are especially helpful

Differentiating simple intestinal obstructions from those that are strangulated is desirable since the latter require immediate operative intervention While some contend that they can classify obstruction cases accurately others maintain that the differentiation cannot be made with any certainty in individual cases especially in the first 24 hours The author s experience with the aged shows that no one symptom or combination of signs and symptoms can be relied upon to differentiate simple from strangulating obstruction Perhaps the most important distinguishing features of the strangulated obstruction are prostration shock, fever a rising leukocytosis, and a high pulse rate However waiting for these signs and symptoms to develop is an open invitation for a fatal outcome in elderly patients since they tolerate shock and necrotic bowel extremely poorly

Generally speaking the possibility of intestinal obstruction must always be considered in making a differential diagnosis in all elderly patients with acute abdominal pain Moreover it is important to recognize that steady pain in this region may be the only sign indicating the presence of a gangrenous loop of intestine radiologic studies and laboratory findings may be negative

In differentiating adynamic or paralytic ileus from mechanical obstruction the most accurate physical finding is the complete absence of bowel sounds save perhaps for a rare tinkle But the most significant diagnostic factor is the patient s history which

might disclose a recent injury of the abdomen spine or pelvis or diseases of the gallbladder pancreas or kidney

The surgeon must not be misled into pursuing a conservative or nonoperative course mainly on the basis of a silent abdomen since an adynamic state may be superimposed upon mechanical obstruction Although this occurs relatively rapidly in elderly patients and may only mean fatigue of the intestinal musculature it may also indicate threatened or actual perforation of the bowel and may also be a near terminal event Moreover peristalsis may never be marked in some cases of strangulation such as mesenteric occlusion or volvulus Operation is by far the safest course if any doubt exists concerning the presence of intestinal obstruction in the aged

TREATMENT OF INTESTINAL OBSTRUCTION

The final objective in the treatment of mechanical intestinal obstruction is the relief of the obstruction and restoration of the patency of the intestinal tract This is best achieved by operation The common deleterious effects produced by intestinal obstruction irrespective of the etiology must be relieved or corrected before operation can be safely performed and the final objective realized These are vomiting distention and loss of body water electrolytes plasma and red blood cells

In the aged special attention must be paid to evaluating function in other organs and systems Experience has shown that elderly patients with severe impairment of such central organs as heart lungs kidneys and liver may safely survive an episode of intestinal obstruction provided that dysfunction in these organs is recognized and correctly treated In addition there are the jeopardizing conditions attendant upon old age which must be considered in the proper evaluation of these patients The surgeon must be cognizant of the metabolic peculiarities and homeostatic limitations of the aged patient These are decreased reserve and increased sensitivity to hypoxia water and electrolyte depletions and excesses trauma infection and absence of essential nutrient materials

Naturally maximum benefits from preoperative preparation are desirable but unnecessary delay in the hope of better preparation is hazardous Early operative intervention is the safer way to avoid the catastrophic effect of late mechanical intestinal obstruction in the elderly patient If success is to be achieved all phases of treatment must be accurately and swiftly performed

Gastrointestinal Intubation

The development of continuous gastrointestinal siphonage as an adjunct to surgical management was an advance of the first magnitude in the field of intestinal obstruction Intubation made it possible to decompress the alimentary tract in intestinal obstruction Decompression of the stomach was the original aim of intubation but the invention of tubes capable of being introduced into the duodenum and the more distal segments of the bowel opened the door to decompression of the small bowel

Both long and short tubes are used to decompress the gastrointestinal tract The Levin tube is the commonly used short tube but is capable of decompressing only the gastroduodenal regions The newer disposable plastic models are better tolerated by elderly patients than rubber ones As with all gastrointestinal tubes periodic saline irrigations are necessary to ensure their patency

Many types of long tubes are available All are modifications of the original Miller Abbott tube which has a double lumen one for intestinal drainage and the other leading to an inflatable balloon at its tip However frequent clogging of the small drainage lumen and the difficulties attendant upon its insertion and passage into the duodenum led to the development of many other types which purport to overcome these objections

Of the many tubes available the author has had greatest success with the Cantor tube which has a single large lumen and ends with an attachable mercury weighted rubber bag

Though some long tubes may enter the small bowel more readily than others it is their frequent failure to do so which is their principal disadvantage This is mainly the result of anatomic variation of the stomach, pylorus and duodenum which frustrates attempts to place the end of tube from being carried onward Thus, these tubes are least likely to be successful in patients who may need them most

Decompression of the distended intestine improves local circulation and thereby reduces bowel wall edema and hurries the return of normal peristalsis Since decompression is gradual the shock which sometimes accompanies sudden deflation of dilated bowel is avoided In addition it facilitates intraabdominal manipulation at operation Most important it prevents vomiting and aspiration of the vomitus which is especially likely to occur when the patient is anesthetized

Improvement following intubation is evidenced by pain relief subsiding distention diminution of the quantity of fluid aspirated appearance of gas in the colon and reduction in size of the bowel loops in radiologic studies and ultimately by the presence of gas and feces in the rectum It should be noted here however that nonoperative management would result in extensive physiologic damage if adequate methods of replacing aspirated fluid and electrolytes had not been developed

When improvement is observed intermittent suction may be substituted for continuous aspiration after a few days Alternate 2-hour periods during which suction is employed and then discontinued may be scheduled If no fluid accumulates during the off period the tube may be allowed to drain by gravity for a 24 hour period The tube may then be withdrawn entirely if adequate function is sustained If the patient fails to improve under intubation the surgeon should conclude that either a slower schedule or surgical intervention is indicated

Indications for Intubation

A short tube of the Levin type is often used prophylactically in any abdominal operation While the need for intubation is minimized by expert anesthesia and skillful surgery, use of the Levin tube is a highly satisfactory method of preventing postoperative distention and ileus It may also serve as the pathway for supplemental feedings If the tube feeding mixture is thin, fine polyethylene tubes may be used since they are more comfortable for the patient

Therapeutically intubation has gained acceptance in paralytic ileus and early postoperative ileus and as an adjunct to the treatment of acute mechanical obstruction But there is considerable dispute among surgeons as to the value of long tube decompression as the sole therapeutic agent in intestinal obstruction Opinions concerning the effectiveness of this tube range from those that consider it extremely useful to those that deem it downright dangerous However such generalization must be avoided when one gets down to individual patients The best approach is to select the therapeutic method which offers the greatest promise to the particular patient under consideration

If the diagnosis in paralytic ileus is made soon after onset when swallowed air is the main cause of distention a Levin tube can satisfactorily decompress the gastroduodenal region Early use of an intestinal tube is also advisable since distention is usually already severe and the difficulties of intestinal intubation in such cases mount as the distention increases

In elderly patients with mechanical intestinal obstruction intubation should be used as an aid rather than a substitute for surgical intervention Except when obstruction occurs soon after an operation patients relieved of the effects of mechanical obstruction through intubation should be treated surgically before they leave the hospital The

author s experience with aged patients indicates that except when extensive intestinal adhesions are encountered as in the chronic repeater or when there is partial obstruction occurring soon after laparotomy or accompanying inflammatory processes long tubes for intestinal decompression should be used only to win time for the surgeon to prepare the patient for surgery improve the operative field or otherwise facilitate the operation Even if the tube does not progress it will perform one of its finest functions which is the prevention of vomiting while the patient is prepared for operation and during the postoperative period

In colonic obstruction because of the imminent danger of perforation early operation is nearly always indicated after first emptying the stomach with a short tube The one possible exception to this procedure is cancer of the cecum or right colonic obstruction with free reflux through an incompetent ileocecal valve Patients with these conditions can often obtain preliminary decompression via a long tube thus facilitating the performance of a one stage right colectomy Nevertheless distention of the small bowel is not necessarily evidence of a patent ileocecal valve Even in the presence of a patent ileocecal valve it is well to remember that perforation of a dilated thinned out colon may occur

The long intestinal tube has uses other than that of decompression An interesting accompaniment of long tube intestinal decompression is the fact that the bowel forms accordion pleats on the tube and thereby occupies less space This fact may be used to advantage in the treatment of a large hernia when reduction is difficult and respiratory embarrassment a hazard after reduction

Abuses and Complications of Intubation

Intubation has its advantages and of course its disadvantages The physician should recognize that the tube may wear out its welcome and that prolonged use after it has served its function may be deleterious to the patient

Short Tubes Prolonged usage and the esophagitis that may result are the main abuses and complications with this type of tube Avoidance of intubation for more than a few days at a time can prevent these harmful effects Elderly patients cough and breathe easier and their countenances brighten when the tube is out

Long Tubes The local complications arising from abuse of long tubes are quite similar to those with short tubes Much more serious is the error in judgment whereby strangulating obstruction is treated by intubation rather than operation Valuable time may be lost and even more serious consequences may ensue by decompressing the small bowel or colon with a long tube when strictures or carcinoma are responsible for the occlusion Failure of the tube to pass the pylorus in 12 hours or failure of the obstruction to improve in 36 hours if the tube has descended into the small bowel are complications that indicate immediate operation

Another highly significant complication is the derangement of fluid and electrolyte balance that may occur unless these materials are adequately replaced Other complications of long tube use are vomiting perforation and even a type of obturation obstruction resulting from inability to deflate the balloon or from intussusception started by the balloon

Complications of a more mechanical nature are knot formation in either the stomach or the dilated intestine which may occur with any type of tube inability to withdraw a balloon tipped tube if the balloon is tied too tightly and rupture of a mercury filled balloon

Because of the difficulties complications and delays accompanying the use of the long tube and because successful decompression is followed frequently by recurrence of obstruction the author has favored use of a Levin tube only and prompt operative therapy in aged patients with intestinal obstruction For instance in this series of 200 aged individuals with intestinal obstruction a long tube was passed into the small bowel in

19 patients Among these operation was avoided in 7 patients and significantly delayed in 9, the 3 remaining patients died during the period of *intubation* The deaths of 2 patients were the results of small bowel perforation while malnutrition and fluid and electrolyte imbalance were lethal in the other

Fluid and Electrolyte Repletion

The recognition of the role of fluid and electrolyte imbalance in determining the course of intestinal obstruction has rightly been hailed as one of the most important developments in this field The toxic absorption theory offered as an explanation of the high mortality rate in intestinal obstruction has been seriously weakened by repeated demonstrations that the lethal effects of obstruction result *primarily from the loss of* the major constituents of the body s internal environment

Most patients with acute intestinal obstruction are dehydrated Not only have they *lost water and salt but there may be deficits* of plasma red cells vitamins and other vital substances Aged patients are especially affected by depletions of these materials since a continual state of moderate dehydration due to reduced extracellular volume and perhaps reduced circulating blood volume is an *apparently normal state in this age group* No set pattern will exist since the degree and type of depletion depends on the level duration, and type of obstruction

Evaluation of replacement therapy must be based on clinical findings and the routine laboratory studies such as hemoglobin hem*atocrit and urinalysis* Blood should be drawn to determine urea nitrogen carbon dioxide combining power and serum sodium potassium and chloride levels While these chemical determinations are a great *aid in the diagnosis and evaluation of* dehydration it is unnecessary to await their results before starting treatment since the exact values will in no way alter initial therapy

To resolve dehydration *isotonic saline* or lactated Ringer s solution should be administered first The immediate advantages of increased serum sodium urinary output and *blood pressure* offset the disadvantage of increased intracellular dehydration and dilution of *extracellular potassium The saline* should be followed by a solution of 5 to 10 per cent glucose in water, which supplies water to the dehydrated cells Of the initial fluids administered about two thirds should be saline or electrolyte solution whereas the others should be nonelectrolyte solutions

The quantity of fluids can be estimated only from the patient s history and weight change remembering however that changes in body weight may lead to erroneous estimates of dehydration since huge amounts *of fluid may lie heavy and stagnant* and therefore useless in the bowel Moreover *unless the degree of dehydration is carefully* appraised too much fluid may be given thus causing hypervolemia and water intoxication a most undesirable state in the aged When dehydration has been mild 2 per cent *of the body weight may be given* while 6 or 10 per cent of body weight of solution should be infused in moderate or severe cases

Sometimes preoperative correction of blood plasma water of electrolyte deficits is unnecessary if the patient with either early acute simple small intestinal obstruction or *acute colon obstruction* had previously been in good health The administration of 1 500 cc of 5 per cent dextrose in water or of saline as the case requires usually suffices

Changes in the acid base balance require correction *Acidosis commonly* present in intestinal obstruction may be corrected by infusing ⅙ *M* sodium lactate Even in the absence of acidosis if dehydration is moderate or severe impaired renal function makes it advisable *to supply extra sodium* Additional sodium is required because although 0 9 per cent is isotonic it is not physiologic since it contains more chloride than exists in the extracellular fluid

The quantity of lactate *administered* varies Generally it should be given until dyspnea and hyperpnea and signs of acido-

sis have subsided The following combinations provide suitable substitutes for the initial quantity of electrolyte or saline solution three parts of saline to two parts of ⅙ *M* sodium lactate, for those with a normal carbon dioxide combining power three parts of saline to one part of ⅙ *M* sodium lactate In shock hepatic or cardiac disease, 1 5 per cent sodium bicarbonate is preferable since there may be impaired lactate metabolism Ampules containing 3 75 Gm of sodium bicarbonate (44 6 mEq Na^+ and HCO_3^-) in 50 cc of sterile water are available

Potassium therapy is contraindicated in dehydration and oliguria unless there is hypokalemia Normal or elevated serum potassium levels are usually seen in intestinal obstruction although large intracellular deficits may coexist When there is a good urinary output and the serum level is known potassium should be administered and continued into the postoperative period until oral intake resumes usually 40 mEq of potassium daily suffices The use of potassium in this manner is important since even a moderate deficit poses a threat to the aged patient following surgery

Whole blood and plasma transfusions are required in patients with strangulated obstructions In fact transfusions may be necessary in those with prolonged moderate or severe dehydration due to simple obstruction Correcting water and electrolyte deficiencies may lead to hypoproteinemia and edema if blood or plasma is not also given However if hemoconcentration is marked whole blood is best withheld until after the initial infusion Plasma is often a better substitute

The rate at which fluid should be administered depends on the type of solution and the needs of the patient To ensure safe early operative intervention repletion must be rapid but not so rapid as to overburden a weakened renal or cardiovascular system Sudden jumps in blood pressure or a circulatory volume may lead to pulmonary edema Solutions containing potassium should be infused slowly because not only may they produce a painful burning sensation but a too rapid elevation in serum potassium may cause cardioplegia Patients in shock regardless of age, may require extremely rapid fluid or blood administration

Complete repletion of deficits is ideal although it is often impossible to achieve this state without harmfully delaying operation Whereas lesser degrees of depletion can generally be completely corrected prior to operation it may be possible to attain only partial replenishments of the deficiencies before operation The remainder of the task must then be reserved for the operative and postoperative periods If replacement therapy begins when the patient is first seen operation can usually be performed safely within hours

While proximal distention and intraenteric pressure may actually oppose edema formation as in the colon severe hyperemia of the involved bowel may develop promptly when distention is suddenly released Because the capillaries have been injured by anoxia the bowel may then evidence increased weeping of serum and multiple petechial hemorrhages This transudation and blood loss goes on for many hours and may lead to acute hypovolemic shock several hours later

The lack of resiliency of the vascular system in the aged prevents rapid adjustment to changes in blood pressure or volume A sudden decrease in blood pressure may cause circulatory insufficiency which may in turn initiate a series of events with which the blood vessels cannot deal It is possible for instance for low blood pressure to start the irreversible and fatal train of thrombosis embolism infarction and anoxemia

It is therefore especially important for the surgeon who deals with geriatric problems to anticipate the possibility of hypotension and to be ready to take steps to restore and maintain normal blood pressure Hence blood or plasma is often necessary during the operative or early postoperative period to guard against peripheral vascular collapse

Antibiotics

Antibiotics are indicated in all strangulated obstructions and may be beneficial in some simple bowel occlusions Clinical observation and experimental evidence strongly suggest that bacteria and their toxins contribute to the lethal effects of strangulated obstruction Antibiotic administration prolongs life in experimental closed loop and strangulated obstruction However such therapy will not take the place of good postoperative care or meticulous surgery The combination of penicillin and streptomycin given parenterally is useful

If peritonitis is present increased dosage in combination with a broad spectrum antibiotic is required unless sensitivity studies indicate otherwise A dilute neomycin solution (100 cc of a 1 per cent solution) may be poured into the peritoneal cavity prior to closure in patients with strangulated obstruction or peritoneal soilage The surgeon and anesthesiologist should be alert to the curare like effect neomycin may exert if it enters the blood stream

Surgical Intervention

Surgery has been and still is the mainstay in the treatment of intestinal obstruction Its aims in acute mechanical obstruction are threefold release of the obstruction re establishment of intestinal continuity (or at least continuity of a segment capable of the desired functions without excessive fluid and electrolyte loss) and resection of nonviable bowel The importance of prompt and accurate diagnosis is obvious since the penalty for late recognition of this rapidly progressive ailment is well known

Anesthesia

The anesthesiologist is of course responsible for selecting the type of anesthesia and the particular agents to be employed His choice is determined by the patient s condition and the nature and duration of the contemplated operative procedure

In dealing with the aged patient it is helpful to be aware of his unusual sensitivity to hypoxia Therefore it may be judicious to administer oxygen in slightly higher than atmospheric concentration for 12 to 24 hours after operation The greatest safety attends the administration of the oxygen by nasal catheter or mask during the immediate post operative period Subsequently an oxygen tent may be used

In patients with intestinal obstruction aspiration of gastric contents is the greatest danger in anesthesia regardless of whether it is local or general Therefore, the stomach must be effectively decompressed throughout the operation and into the postoperative period In addition, an endotracheal tube should be in place in all patients requiring general anesthesia and even in some who are operated upon under local anesthesia

When abdominal distention is marked in the older age group as it frequently is in most large bowel obstructions one should be aware of the problems of anesthesia created by the probable coexistence of cardio vascular and renal disorders and other de generative diseases A shallow plane of anes thesia in combination with an adjuvant muscle relaxant hence is most satisfactory in elderly patients

If the procedure planned requires little intraabdominal manipulation as in the case of colostomy or herniоplasty local anesthesia is satisfactory If warranted by the patient s condition more extensive operations can be performed under local anesthesia In such cases the parietal peritoneum may be anes thetized by bathing the peritoneal cavity with a diluted solution of an anesthetic agent Infiltration of the base of the mesentery will prevent the discomforts of traction on the bowel Generally however general anes thesia provides the best operating conditions and with modern techniques is safe

General Operative Conduct

The surgeon operating on aged patients does well to be mindful of their increased susceptibility to trauma and shock Essential

therefore are delicate technique gentle handling of all tissue and careful hemostasis Best results are obtained if the procedure is short and simple Formidable resections and the correction of incidental pathologic conditions will only increase the morbidity and mortality

Unless the site and cause of the obstruction are known the best approach is through a right rectus incision extending it if necessary Even though there is a prior incision it may be advisable to make a fresh one since intestine may be attached to the old one Unless great care is exercised intestinal injury may result Once the point of obstruction is found by tracing the dilated or undilated bowel appropriate measures for its relief are taken The type of the operation therefore depends on the nature of the obstruction and the condition of the patient

Surgery in Simple Obstructions

Simple lysis of an adhesion is all that many patients with simple small bowel obstruction require More commonly the division of adhesions is a fairly arduous operation because they form a mass of adherent omentum and gut The first step is to separate the omentum and adherent bowel from the peritoneum by sharp dissection The deeper adhesions then are exposed and divided Traumatized omentum should be excised After the adhesions have been cut the surgeon should carefully inspect the remainder of the peritoneal cavity to make certain that no other adhesions are left behind which might give rise to obstruction in the future If there is extensive scarring or constriction of the lumen or if the wall of the bowel is traumatized during lysis of the adhesion resection should be performed

Enterectomy or resection of the small bowel is necessary if the obstructing lesion is a neoplasm or a benign stricture The continuity of the intestinal tract should be reestablished by an end to end anastomosis Dilated and edematous small bowel may be safely anastomosed and there is little difficulty in matching the ends of the dilated and undilated bowel The method of anastomosis (open or closed) probably has little to do with the result In general the author prefers the closed aseptic technique since there is less soiling of the operative field (Fig 18 8) *Bypassing operations* or lateral anastomoses are occasionally indicated in the presence of fistulas inflammatory lesions irremovable tumors and carcinomatosis

An aseptic *enterotomy* and decompression of the bowel is often indicated especially when distention is marked Special instruments and tubes have been designed for this purpose although a rectal tube or catheter serves satisfactorily Decompression of the bowel by enterotomy facilitates manipulation of the bowel and abdominal closure shortens the period of postoperative intestinal paresis and avoids the danger of delaying operative intervention while attempts are made to decompress the bowel by an intestinal tube If a long tube has been passed into the stomach it sometimes may be manipulated into the small bowel substituting for enterotomy Generally however attempts to accomplish this terminate with failure plus considerable mauling of the gastrointestinal tract

Rarely an *enterostomy* is required as a lifesaving procedure if the patient is in a precarious condition This procedure should be avoided if at all possible since it may be trying to the patient and the resultant fluid loss may be serious

Obturator obstruction usually requires an enterotomy to remove the gallstone enterolith bezoars food boli or other foreign bodies plugging the lumen If the obturator can be dislodged proximally the enterotomy can be performed in normal bowel Sometimes it may be broken up or milked into the colon thereby avoiding enterotomy Resection of the impaction site is necessary when damage or erosion to the intestinal wall has occurred The bowel should be searched for other foreign bodies Despite the possibility of additional gallstones escaping into the bowel all attempts at investigating or correcting biliary tract abnormalities in gall

stone ileus should be postponed until the patient has recovered from the obstruction

Colostomy performed in the proximal transverse colon and of the loop or double-barrel type is the best method of dealing with simple obstruction of the left colon By this procedure obstruction is relieved promptly and permanently, the fecal stream is divided and there is little risk of soilage or bacterial contamination of the peritoneum A colostomy in this location does not hamper subsequent surgical procedure on the colon and is compatible with colostomy appliances If the lesion is a nonresectable carcinoma colostomy performed more distally (in the sigmoid in the case of rectal tumors) is more

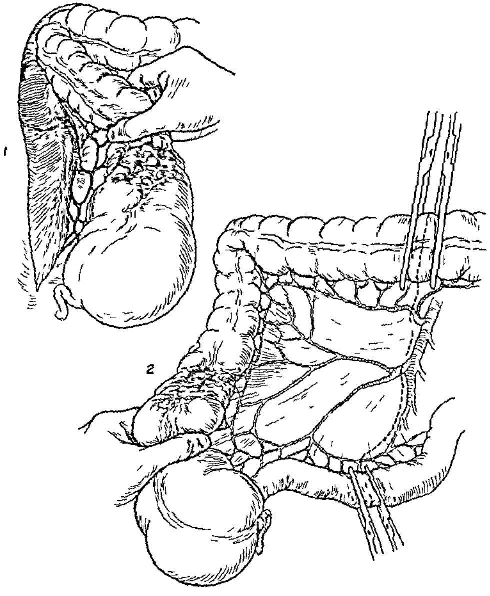


Fig 18 8 Right colectomy and end to end anastomosis of ileum and transverse colon 1 The peritoneal reflection of the ascending colon has been incised and the bowel reflected Careful dissection will avoid injury of the infracolic portion of the duodenum and the ureter 2 The transverse colon is divided between Allen clamps just to the right of the middle colic artery The ileum is divided in a similar fashion After interrupting the blood supply the bowel is removed These latter steps are sometimes performed first before incising the gutter and removing the bowel Steps 3 through 7 clearly show the technique of a closed aseptic end to end anastomosis The method is applicable to all intestinal anastomoses although ileocolostomy is illustrated

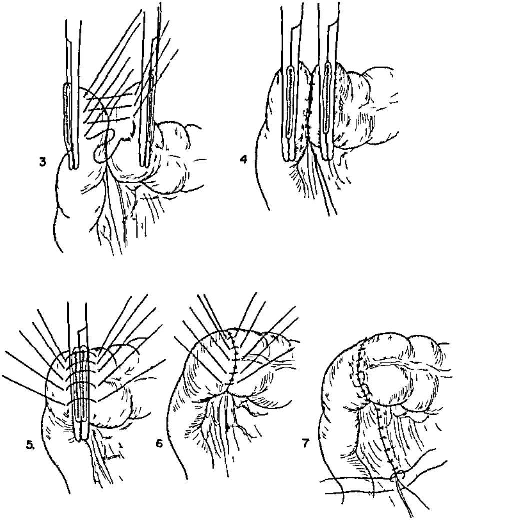


Fig 18 8 (continued)

desirable since they function better than those located proximally in the colon

Transverse colostomy is easiest to perform because of the transverse mesocolon It is constructed in the following manner (Fig 18 9) After making a transverse incision the distended transverse colon is identified and withdrawn The omentum is separated and returned to the peritoneal cavity To keep the bowel from retreating into the ab domen a glass rod is immediately passed under it The ends of the glass rod are con nected by a rubber tube so that the rod cannot be removed If a relatively short in cision has been made no further wound closure is necessary Suturing the bowel to the fascia is desirable but it is dangerous in dilated tissue paper thin colon

Nearly aseptic decompression of the colon may then be accomplished by inserting a large catheter into the proximal portion of the colon and anchoring it by a purse string suture However if there is huge colonic dis tention its decompression is required before withdrawing the colon from the abdomen The peritoneal cavity is completely sealed off 24 to 36 hours later and the colostomy may then be opened wide by incision

A more satisfactory procedure but one which must be reserved for less acute in testinal obstruction consists in completely dividing the transverse incision at the time of operation by suturing a skin bridge be tween the two stomas This type of operation should be performed whenever complete de functioning of the distal colon is desired and

possible, as in patients with diverticulitis More complicated procedures offer no ad vantages in such cases

Whenever performing a transverse colostomy for acute left colon obstruction the surgeon must resist the temptation to explore the abdomen save for a sweep of the finger over the liver There is little likelihood of determining the cause of the obstruction by palpation whereas there is great danger of traumatizing and perforating the dilated colon

Decompression of the left colon by *tube cecostomy* is unsatisfactory Often it is diffi

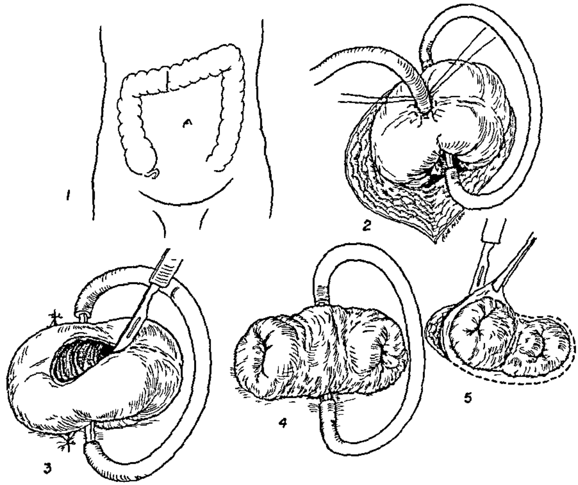


Fig 18 9 Transverse colostomy and closure of colostomy 1 A short incision vertical or preferably transverse is made to reach the transverse colon 2 A loop of transverse colon freed of omentum is withdrawn *A glass rod has been passed through an avascular area of the mesocolon and this prevents the loop from returning to the peritoneal cavity* A mushroom catheter held in place with a purse string suture effects immediate decom pression 3 The bowel is *opened wide 24 to 36 hours later* 4 *A healed colostomy* The glass rod may be removed in about 10 days 5 *When closing a transverse colostomy* the skin is incised close to the bud of the bowel 6 The rim of skin has been excised and the bowel is dissected from the subcutaneous tissue fascia and peritoneum *Soiling of the peritoneal cavity may be minimized by avoiding extensive division of intraabdom inal adhesions* 7 The bowel is closed transversely with interrupted Lambert sutures of fine silk and replaced in the abdomen 8 The peritoneum muscles and fascia are defined and then approximated in layers with catgut or wire sutures 9 *Although the skin and subcutaneous tissue may be closed primarily it may be advisable to use the delayed pri mary method in old persons with thick panniculi so as to minimize the chance of infec tion* The moist pack is removed 36 to 48 hours later and the previously laid skin sutures secured

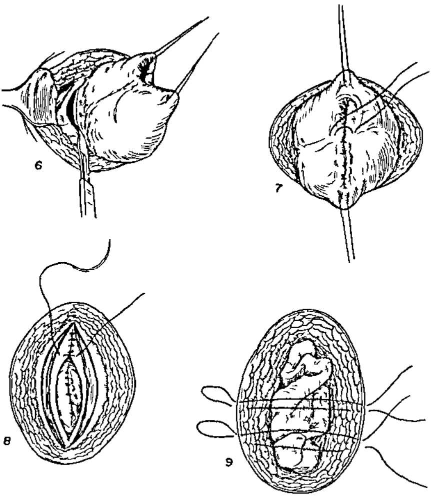


Fig 18 9 (continued)

cult to perform aseptically It does not divert the fecal stream and in most instances does not adequately *decompress the colon* Mortality rates rise abruptly when it is used in preference to a colostomy Nevertheless cecostomy may possibly be of use in the gravely ill patient but it should be followed by colostomy at a later date

Greater latitude exists in the treatment of simple obstruction of the right colon A *right colectomy* and primary end to end anastomosis is the procedure of choice provided the patient s condition is satisfactory (Fig 18 8) Anastomoses performed under these circumstances are successful since normal colon is joined to normal or slightly dilated ileum Under no circumstances however should an anastomosis be attempted in dilated septic and edematous colon Such anastomoses frequently break down and in addition the great disparity in the lumen *would create technical difficulties*

A cecostomy may be resorted to if the condition of the patient prevents more than the simplest procedure and the obstruction is in the distal right colon Obstruction due to cecal lesions or irremovable right colon tumors in the presence of a patent ileocecal valve may be bypassed by a side to side ileo transverse colostomy A better procedure is an end to side ileotransverse colostomy with exteriorization of the distal ileum Then the cecum can be decompressed by passing a catheter into it

Surgery in Strangulation Obstruction

Determining Viability The most important consideration in attempting to relieve stran-

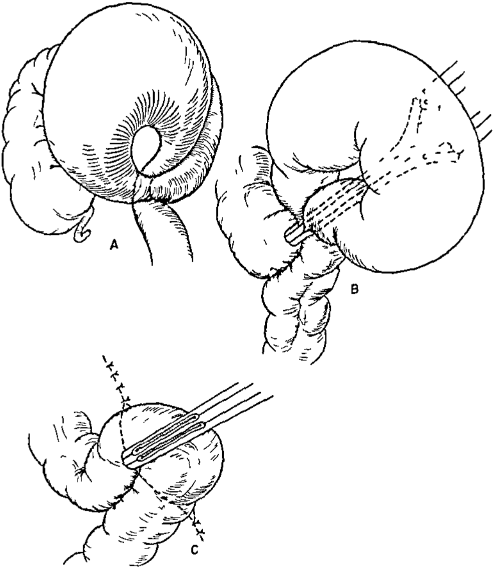


Fig 18 10 Mikulicz or obstructive resection for volvulus of the sigmoid *A* While especially applicable in dealing with dead or lacerated colon it may occasionally be a useful procedure when the small bowel is necrotic *B* The necrotic bowel is exteriorized By suturing the bowel together on the antimesenteric border the colon distal and proximal to the lesion forms a spur A Rankin clamp is applied to the spur *C* The bowel is sutured to the peritoneum and abdominal fascia When the abdomen is closed the bowel is divided

gulated obstructions is the viability of the bowel segment involved One or more of the following three criteria will help the surgeon to determine viability in most cases restoration of color within 1 to 15 minutes after the strangulation is released return of pulsations in the small arterioles on the surface of the bowel and the return of peristaltic contraction upon stimulation such as by pinching

It is vital that the surgeon have no doubt whatsoever as to the viability of the bowel segment The only truly safe generalization would appear to be the one tersely stated by Wangensteen When in doubt resect

Management of Small Bowel Necrosis In small bowel obstruction involving a nonviable segment of bowel the only practical procedure in most cases is primary resection and end to end anastomosis As pointed out above this may be safely accomplished in the small intestine Occasionally exterioriza

tion of the dead bowel, which is excised after the abdomen is closed is required when the patient's condition is such that only the simplest possible procedure can be done

Strangulated Hernia The possibility of strangulation in intestinal obstruction due to hernia makes prompt attention a must Sometimes taxis may be employed to reduce hernia if incarceration has just occurred However manipulation must be gentle since the bowel may be further damaged or even ruptured

Surgery is the most desirable course to pursue when a hernia has been obstructed for more than 4 hours or if fever and leukocytosis are present In such cases the hernial sac should be exposed and opened and then the contents inspected for viability before returning them through to the abdomen If viable the bowel is gently manipulated under direct vision replaced in the abdomen and the hernia repaired It is sometimes necessary to enlarge the hernial ring by incision to permit the bowel to reenter the abdomen without trauma or taxis since very little tension is needed to tear the occluded loop

If a strangulated hernia reduces itself after anesthesia has induced relaxation but before the operation the only safe course is to enlarge the incision and to examine the bowel directly for necrosis

Mesenteric Occlusion Massive resections are usually required in patients with mesenteric occlusion Such resections are not necessarily incompatible with life *Embolectomy* or *endarterectomy* should be performed if the bowel is not frankly necrotic By successfully accomplishing this procedure massive resection may be avoided However nothing less than resection can be done in the case of mesenteric vein thrombosis All patients with mesenteric occlusion should receive anticoagulant drugs This therapy will help prevent recurrent embolization thrombosis and thrombotic propagation in the mesenteric system since these lethal factors often cause death in the postoperative period

Volvulus of Sigmoid Volvulus of the sigmoid unaccompanied by necrosis may be simply reduced Because of the tendency to recur, the sigmoid involved by volvulus should be excised and managed as though it were necrotic This is similarly true in the rare case of volvulus of the transverse colon

In dealing with a dead colon segment exteriorization is the only safe operative procedure This is so whether or not distention also is present The technique used is known as the *Mikulicz exteriorization procedure* or *obstructive resection* (Fig 18 10)

Essentially the procedure consists of dividing the mesentery at the proximal and distal ends of the segment The nonviable bowel segment then is gently lifted to the exterior surface of the abdomen along with about 4 to 5 cm of the viable gut adjoining each end The necrotic bowel segment should not be resected or decompressed until the abdomen is closed in order to avoid operative spillage or soilage within the peritoneal cavity A second operation must then be performed to close the colostomy made by this procedure

Volvulus of the Cecum Volvulus of the cecum may be reduced if the bowel is not gangrenous Recurrence can be prevented by suturing the mobile cecum to the parietal peritoneum of the right abdominal gutter A better method because the cecal distention is frequently enormous is to perform a tube cecostomy which not only fixes the cecum to the abdominal wall but decompresses it as well When gangrene is present resection of the involved bowel and primary or delayed anastomosis is the only recourse

BIBLIOGRAPHY

Albert J H and Smith L L A Comparison of Cecostomy and Transverse Colostomy in Complete Colon Obstruction Surg Gynec & Obst 95 410 1952

Barnett W O Griffin J C and Hardy J D The Efficacy of Antibiotics Combined with Irrigation in Experimental Strangulated Intestinal Obstruction Surg Gynec & Obst 106 38 1948

Barnett W O and Stanley T V The Treatment of Experimental Strangulation Obstruction A M A Arch Surg 77 196 1958

Becker W F Davis C E Jr and Lehman E F Intestinal Obstruction Ann Surg 131 385 1950

Benedeck T E and Raffucci F L Intestinal Obstructions An Analysis of 275 Cases with Operation A M A Arch Surg 75 179 1957

Blain A III Penicillin in Experimental Intestinal Obstruction—A Summary of Observations with Reference to Their Clinical Application Surg Gynec & Obst 84 753 1947

Bland J H *Clinical Recognition and Management of Disturbances of Body Fluids* 2d ed W B Saunders Company Philadelphia 1956

Bohlmann A Intestinal Occlusion in the Aged Deutsche Gesundheitswesen 12 331 1957

Bollinger J A and Nabers L W Acute *Small Bowel Obstruction in Old Age* J Am Geriatrics Soc 3 817 1955

Bruusgaard C Volvulus of the Sigmoid and Its Treatment Surgery 22 466 1947

Cantor M O New Simplified Intestinal Decompression Tube Am J Surg 72 137 1946

Cohn Isidore Jr *Strangulation* Obstruction Antibiotic Protection Surgery 39 630 1956

Donhauser J L and Atwell S Volvulus of *the Cecum with a Review of 100 Cases in* the Literature and a Report of Six New Cases Arch Surg 58 129 1949

Drugas T G and Schiff C A Acute Obstruction of the Small Intestine Brit J Surg 68 612 1954

Elkington J R and Danowski T S *The Body Fluids—Basic Physiology and Practical Therapeutics* The Williams & Wilkins Company Baltimore, 1955

Ferguson L K Smith D C and Houston P C Intestinal Obstruction in the Aged Geriatrics 4 341 1949

Goldstein M S Beye C L and Ziffren S E *Intestinal Obstruction in the Aged* J Am Geriatrics Soc 1 205 1953

McLaughlin C W and Brush J H Factors Responsible for the Improved Results in the Management of Acute Intestinal Obstruction Arch Surg 61 115 1950

Nemir P Jr Progress Report on Acute In*testinal Obstruction Am J M Sc 223 198* 1952

Nemir P Jr Gallstone Ileus—Report of Eight Cases Surg Gynec & Obst 94 469 1952

Noer R J Intestinal Obstruction Surgery 42 1122 1957

Owen R A C and Murphy, A F Surgery in Old Age Brit M J 2 186 1952

Sands W The Survey Roentgenograms as an Aid in the Diagnosis of Acute Abdominal Conditions Surg Gynec & Obst 97 4 1953

Standeven A Acute Abdomen Diseases in Old Age Brit M J 2 1184 1955

Wagensteen O H *Intestinal Obstruction—A Physiological Pathological and Clinical Consideration with Emphasis on Therapy Including Description of Operative Procedure* 3d ed Charles C Thomas Publisher Springfield Ill 1955

Wantz G E and Glenn F Intestinal Obstruction in the Aged J Am Geriatrics Soc 3 974 1955

Welch C E *Intestinal Obstruction* The Year Book Publishers Inc Chicago 1958

19

Hernia

S Frank Redo

The problem of hernia has been with mankind for millenia and has been treated in many ways often without success Halsted in 1893 in a historical section preceding his report of 82 cases of the radical cure of inguinal hernia in the male listed seven methods of treatment in use from the time of the Middle Ages to the introduction of antiseptic surgery These were as follows

1 Pressure with or without the simultaneous application of irritating or so called contracting remedies

2 Caustics and the actual cautery

3 Ligature of the sac with or without cutting it off

4 Introduction of foreign bodies into the hernial sac

5 Healing in of a detached portion of skin or a portion of impacted skin into the abdominal ring

6 The injection of irritating fluids within or outside of the hernial sac

7 The subcutaneous suture

He noted that some of these methods were interesting as curiosities and others because they were still being practiced

Halsted quoted Schuh [1] as saying If no other field were offered to the surgeon for his activity than herniotomy it would be worthwhile to become a surgeon and to devote an entire life to this service The results of hernia repair to the time of Halsted and Bassini were extremely poor Indeed Halsted wrote in 1892 Today, therefore the *majority* of surgeons operate for the radical cure of hernia only when the hernia is strangulated or cannot be retained with a truss A *few* believe that they have results good enough to justify their operations upon almost every case which presents itself

Although Lister s antiseptic methods were introduced in 1869 it was not until 1888 when Bassini described his operation followed closely by Halsted s report in 1889 that the true break through in the problem of hernia correction was made The earlier cases operated on and reported were in younger patients generally In Halsted s initial series of 82 only 2 patients were over 50 they were 58 and 59 years of age respectively

As recently as 20 years ago the patient of 60 or more years with a symptomless reducible hernia was usually treated by observation and a truss The occasional elderly patient subjected to operation was one admitted with an obviously incarcerated and possibly strangulated hernia

Better preoperative evaluation and post operative management especially early ambulation have made surgery the preferred method of treatment Whereas in the past many aged persons were seen who required emergency herniorrhaphies it is likely that the incidence of these procedures will decrease as more and more patients undergo elective repair before strangulation occurs

[1] A prominent Viennese surgeon who contributed much to surgical literature in late 1850s and early 1860s.

Age in itself is not a contraindication to operative correction of hernia The statement quoted from Halsted might better be paraphrased, in 1958, to read The majority (of surgeons) *believe that they have results* good enough to justify their operations upon almost every case which presents itself, including patients 60 years and older

DEFINITION

By *hernia is meant the* protrusion of any viscus from its natural cavity through congenital or acquired openings in the surrounding structures McVay enlarged upon this definition and considered that the defect in *the musculoaponeurotic* and fascial continuity of the abdominal wall is the important point since it is the size of this defect which is the main problem in the repair He proposed as a better definition An abdominal hernia is a defect in the normal musculoaponeurotic and fascial continuity of the ab*dominal wall* either congenital or acquired which permits the egress of any structures other than those which normally pass through the parietes

The terms usually applied to hernia, other than the *anatomic location*, have to do with the condition of the protruding mass A *reducible* hernia is one in which the mass can be returned to its usual or normal environment as contrasted with the *irreducible* hernia in which the mass cannot be replaced The term *incarcerated* is frequently used to mean irreducible and as a synonym for it Other surgeons however prefer to reserve the term as *indicative* of strangulation or circulatory embarrassment of the hernial contents Certainly a patient with a hernia that has been irreducible for many years could hardly be considered to have an incarcerated hernia from the point of view of those who hold that incarceration means strangulation This term is undoubtedly widely misused If the change from reducibility to irreducibility is examined perhaps *the mechanism* may serve to clarify the confusion When a previously reducible hernia becomes irreducible, it probably undergoes some degree of vascular embarrassment initially After this it either continues to evidence obvious strangu*lation or*, if it does not reduce itself, remains irreducible When repaired the irreducible hernias always contain abdominal contents part of which are attached to the sac by adhesions These adhesions probably represent reaction secondary to mild or localized peritonitis due to the circulatory embarrassment Thus, the term *incarcerated* should best be reserved for the hernia which has suddenly become irreducible If the constriction becomes marked strangulation will result If it is only partially obstructive, peritoneal reaction may ensue with *fixation of the sac* and the formation of an irreducible hernia After the immediate period of incarceration the term *irreducible* is preferred

Diagrammatically this concept may be indicated as follows

Reducible hernia ⇄ Incarcerated hernia → Strangulated hernia
↓
Irreducible *hernia*

All irreducible hernias have undergone a period of incarceration

Anatomy

The anatomy of the inguinofemoral region is worthy of consideration since it is only with a thorough knowledge of this area that an accurate attempt at repair can be undertaken

The inguinal canal through which pass the ilioinguinal nerve and the spermatic cord *in the male and the ilioinguinal nerve* and round ligament of the uterus in the female, is an oblique canal about 4 cm in length lying a little above and parallel to the inguinal ligament It extends downward forward and medially from the internal inguinal ring the opening in the transversalis fascia through which the cord in the male or round ligament in the female passes to the external inguinal

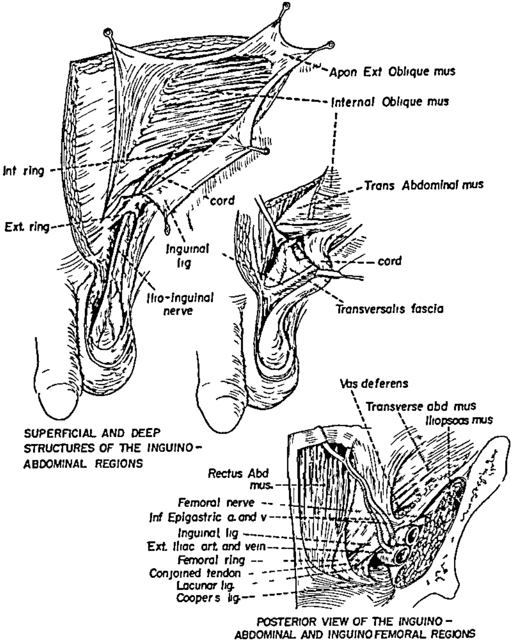


Fig 19 1 Artist s sketch of the anatomy of the inguinofemoral region simplified to show the more important structures as discussed in the text

ring the defect in the external oblique aponeurosis through which the spermatic cord or round ligament of the uterus continues out of the abdominal wall It is bounded in front by the external oblique aponeurosis throughout its whole length and by the internal oblique muscle in its lateral third behind chiefly by the transversalis fascia the inguinal aponeurotic falx (or internal oblique muscle in the area of this structure) and the reflected inguinal ligament of the external oblique (when present) above by the arched fibers of the internal oblique and transversus abdominis muscles below by the union of the transversalis fascia with the inguinal ligament and at its medial end by the lacunar ligament The prolongation of this ligament over the superior ramus of the

pubis, Cooper's ligament, although not part of the inguinal canal, is an important anatomic landmark and structure so far as hernia repair is concerned

The spermatic cord as it passes through the abdominal wall becomes loosely invested by the internal spermatic fascia or infundibuliform fascia arising from the transversalis fascia, next by the cremaster muscle fibers, originating from the internal oblique, and lastly by the external spermatic fascia arising from the intercrural fibers of the external oblique aponeurosis It must be remembered that in locating a hernia sac that lies in the cord each of these structures must be separated before the peritoneal extension is exposed

The *femoral canal* is the most medial compartment of the subdivided femoral sheath This latter structure is formed by a prolongation of the transversalis fascia in front of the femoral vessels and the iliac fascia behind The sheath is funnel-shaped, with the open end directed upward The lower end fuses with the fascial covering of the vessels about 4 cm below the inguinal ligament The sheath is divided by two vertical partitions into three compartments The femoral artery is contained in the lateral, the femoral vein in the central and the femoral canal in the medial compartment Containing some lymphatics and a lymph node in a small amount of areolar tissue the femoral canal is conical and measures about 1 25 cm Its upwardly directed base, or proximal opening called the femoral ring is bounded in front by the inguinal ligament behind by the pectineus muscle covered by the pectineal fascia medially by the crescentic base of the lacunar ligament and laterally by the fibrous septum on the medial side of the femoral vein The portion of somewhat condensed extraperitoneal fatty tissue which closes the ring is called the femoral septum Immediately subjacent on the abdominal surface, is the peritoneum The spermatic cord in the male or the round ligament of the uterus in the female lies immediately above the anterior margin of the ring while the inferior epigastric vessels are close to its upper and lateral angle (Fig 19 1)

The anatomy in the aged remains the same but the laxity of ligamentous and muscular structures and the accumulation of fat, including properitoneal deposits, sometimes makes precise definition of structures and anatomic landmarks more difficult These same factors contribute to the difficulties of repair

Etiology

In the older age group, the etiologic factors for the development of hernia are the same as those in younger persons For the formation of indirect hernia, in which the sac protrudes from the internal ring and through the inguinal canal lateral to Hesselbach's triangle (the area bounded medially by the lateral border of the rectus muscle, inferiorly by the inguinal ligament, and laterally by the deep epigastric vessels), there is a persistent preformed peritoneal sac of congenital origin This may be present without evident hernia for many years because of the strong sphincterlike action of the internal oblique muscle fibers over the internal ring which approximate themselves to the inguinal ligament and close over the region like a shutter when the abdominal muscles contract With age however and a loss of muscle tone, this shutter mechanism may become less effective In addition the accumulation of both intraperitoneal and properitoneal fat contributes to an increase in intraabdominal pressure and a decrease in the efficiency of the action of the internal oblique muscles over the internal ring Obviously such conditions as chronic constipation cough prostatism heavy lifting or straining increase intraabdominal pressure Under these conditions if the prerequisite for hernia formation namely, the persistent remnant of the vaginal process is present the probability of the development of an indirect hernia is great

The direct hernia a protrusion through Hesselbach's triangle *i e* medial to the deep epigastric vessels probably also owes its origin to a congenital anatomic predisposi

tion but one completely different from that leading to the indirect type According to Zimmerman and Anson the defect is a con genital poorly developed musculofascial wall with the absence of the lowermost fibers of the internal oblique muscle Given such an abdominal wall the retention of the intra abdominal pressure rests upon the fascia forming the posterior wall of the inguinal canal Increased intraabdominal pressure as mentioned before may lead to hernial pro trusion Especially is this true in the older age group where this single retaining struc ture may become attenuated or lax or both

It should be emphasized that in both forms the immediate cause of the hernia is the in crease in intraabdominal pressure This may be the result of chronic occupational or physiologic strains of living or of a single excessive effort

The etiology of femoral hernia is not well established Unlike inguinal hernia most surgeons do not attribute it to any congenital predisposition The fact that it is several times more common in the female than the male leads to the conclusion that the differ ence in the inclination of the pelvis may play a significant role coupled with the increase in intraabdominal pressure associated with pregnancy In the older age group it is prob ably related to the general loss of tissue tur gor and elasticity and an increased intra abdominal pressure possibly the result of accumulation of intraabdominal and properi toneal fat

Postoperative ventral hernias are the result of poor healing of the surgically created de fect This may be the result of faulty or incomplete approximation of layers at the time of operative closure strangulation of tissue owing to improper placement of su tures or excessive strain or stress prior to complete healing of the wound However the one single factor that precedes the de velopment of postoperative ventral hernia is wound infection In 123 cases of postopera tive ventral hernia occurring at The New York Hospital over the period 1932 to 1958 28 patients or 22 8 per cent had had a wound infection prior to the development of the hernia In the aged poor nutrition obesity, hypoproteinemia and vitamin C de ficiencies, in addition to tissue laxity may contribute to a moderate degree There is general agreement that vertical incisions par- ticularly paramedian with split of the rectus muscle fibers are more prone to postopera tive ventral herniation than are transverse incisions or longitudinal ones with rectus muscle retraction

For the development of umbilical hernia there must be a congenital predisposition or a defect in the umbilical scar and an increase in intraabdominal pressure Most of the um bilical hernias seen in those over 60 years of age have been present since earlier life and in the female they are associated with pregnancy Chronic cough constipation pro- statism obesity and ascites may lead to the development of umbilical hernia in the elderly

The etiology of epigastric hernia is prob ably the combination of a congenital apo- neurotic defect and increased intraabdominal pressure It has been held too that these hernias may have their origin in the musculo- aponeurotic openings through which pass perforating blood vessels

Incidence

During the years 1932 to 1958 a total of 5 526 hernias were encountered at The New York Hospital Of these 958 or 17 3 per cent were in patients over 60 years old The relative frequency of the occurrence of the abdominal wall hernias in people 60 years of age and older is listed in Table 19 1 and Fig 19 2

A total of 958 hernias were encountered in 775 patients Of these 131 were recur- rent hernias having been repaired originally in some cases at The New York Hospital and in the majority of instances at some other hospital Many of the primary repairs had been performed before the patient reached the age of 60 and indeed many had re curred before the patient had attained that age Of this recurrent group there were 108

TABLE 19 1 RELATIVE INCIDENCE AND SEX DISTRIBUTION OF ABDOMINAL WALL HERNIAS *

Age yr	Inguinal								Femoral		Postoperative ventral		Umbilical		Epigastric	
	Indirect		Direct		Dir and indir		Sliding †									
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
60–69																
Primary	2?5	27	116	6	46	1	(21)	(1)	18	32	0	41	11	12	6	4
Recurrent	9	3	43	5	4	0	(5)	(1)	5		1	5	0	2	0	0
0– 9																
Primary	76	2	47	2	19	0	(16)	(0)	9	21	18	13	6	5	2	0
Recurrent	8	0	10	0	3	0	(0)	(1)	0	1	2	1	1	0	0	0
80–89																
Primary	1?	1	3	0	3	0	(2)	(0)	1	1	0	1	0	0	0	0
Recurrent	1	0	?	0	0	0	(1)	(0)	0	0	0	1	0	0	0	0
	351	3	21	13	75	1	(45)	(3)	33	59	61	6	18	19	8	4
Total	384		234		76		(48)		9?		1 3		37		12	
Grand total 958																
Per cent of total	40 07		24 42		7 93		(5 01)		9 60		12 83		3 86		1 5	
	36 65	3 4	23 07	1 35	7 83	0 10	(4 70)	(0 31)	3 44	6 16	6 37	6 47	1 88	1 98	0 83	0 4
Total (excluding recurrences)	313	30	166	8	68	1	(39)	(2)	8	54	58	55	17	17	8	4
Grand total (excluding recurrence) 8 7	343		174		69		(41)		8		113		34		1	
Per cent of total (excluding recurrences)	41 47		1 04		8 46		(4 95)		9 91		13 66		4 11		1 45	
	37 85	3 6?	20 7?	0 3	8 34	0 12	(4 71)	(0 4)	3 38	6 53	7 01	6 65	2 05	0 5	0 9	0 48

* The New York Hospital Cornell Medical Center patients 60 yr and older 193? 1958

† Included in the figures for direct and indirect hernias

inguinal (41 indirect 60 direct, and 7 combined direct and indirect) 10 femoral, 10 postoperative ventral and 3 umbilical hernias A more detailed analysis of these figures will be found below in the section on Recurrent Hernia

The remaining 827 hernias which had not been operated on before were distributed as follows 586 inguinal (343 indirect 174 direct, and 69 combined direct and indirect) 82 femoral 113 postoperative ventral, 34 umbilical and 12 epigastric

In each instance the largest number of patients were in the 60 to 69 year age group

The inguinal group (all types) made up 71 per cent (41 5 per cent indirect 21 per cent direct 8 5 per cent combined) femoral 9 9 per cent postoperative ventral 13 6 per cent umbilical, 4 1 per cent, and epigastric 1 4 per cent of the hernias These figures may be compared with those of Mc Vay taken from the population as a whole including all age groups In this group of 3 395 hernioplasties there were 60 3 per cent indirect inguinal, 15 1 per cent direct inguinal, 3 3 per cent femoral 9 4 per cent umbilical 9 1 per cent postoperative ventral, and 1 6 per cent epigastric hernias Zimmerman and Anson, reviewing the relative incidence of the various types of hernias (all ages), have collected 98,743 cases (this excludes a series of 1,371 hernias reported by Grace and Johnson in patients over 50 years of age) Of this entire group, 82 3 per cent were inguinal (all types), 5 4 per cent femoral, 8 5 per cent umbilical 1 7 per cent postoperative ventral and 2 1 per cent epigastric hernias In the group reported by Grace and Johnson 1 371 cases in patients over 50 years of age there were 90 4 per cent inguinal 3 6 per cent femoral 2 5 per cent postoperative ventral 2 4 per cent umbilical and 1 0 per cent epigastric hernias

Iason in a review of 175 cases of hernia in patients 60 years and older reported an incidence of 78 per cent inguinal (all types), 8 1 per cent femoral 11 6 per cent postoperative ventral 2 9 per cent umbilical and 0 6 per cent epigastric hernias [2]

Harkins s figures obtained by combining

[2] Iason includes four cases of Spigelian hernia and two of diaphragmatic hernia but these latter two were not included in obtaining the values listed above

percentages given in various texts plus personal observations are 78 per cent inguinal (56 per cent indirect, 22 per cent direct), 6 per cent femoral 10 per cent postoperative ventral (probably includes epigastric), 3 per cent umbilical hernias, and 3 per cent of other types

Thus comparison of the incidence of the various hernias in the aged with that in the population as a whole reveals a somewhat higher figure for postoperative ventral femoral and direct inguinal hernias Such was the case in The New York Hospital group as compared with the cases reported by McVay and Zimmerman The small series reported by Iason has the same type of incidence The group reported by Grace and Johnson which contained patients over 50 but under 60 as well as those over 60 (average age 57) has a distribution more like that in those series that include all age groups Harkins s figures, presumably covering all age groups are higher for indirect inguinal hernias than is The New York Hospital older age group but they are almost the same for direct and umbilical hernias The incidence of postoperative ventral and femoral hernias in the aged group is higher when compared with any of the other series that include patients of all age groups (Table 19 2)

Sex Distribution

In patients over 60 as in the younger age group hernia is more common in the male than in the female The New York Hospital series considering primary hernias only reveals that indirect inguinal hernia is about ten times more common in males than in females while direct hernias are twenty times more common in the male than the female Femoral hernias are 1 9 times more

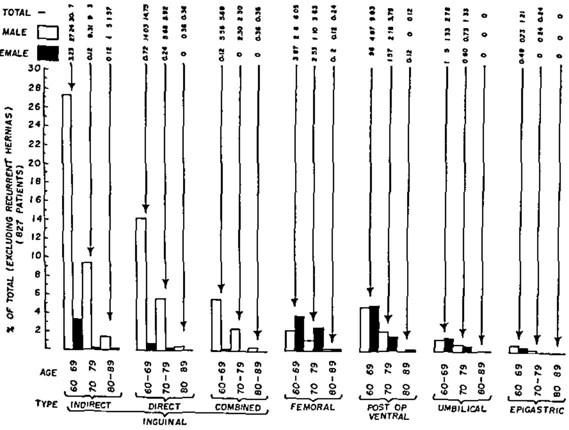


Fig 19 2 Bar graph indicating the sex and age distribution of the various hernias in patients 60 years and older at The New York Hospital (1932–1958) The figures do not include patients who had recurrent hernias

TABLE 19 2 RELATIVE INCIDENCE OF VARIOUS TYPES OF HERNIA

Source	Total cases	Inguinal %	Femoral, %	Postop ventral %	Umbilical %	Epigastric %
All ages						
Zimmerman and Anson (excluding series of Grace and Johnson)	98 743	82 3	5 4	1 7	8 5	2 1
McVay	3 395	75 4 (indir 60 3 dir 15 1)	3 3	9 1	9 4	1 6
Harkin	Not given	78 (indir 56 dir 22)	6 0	10 0	3 0	(? included in postop ventral group)
50 yr and over						
Grace and Johnson	1 371	90 4 (indir 65 dir 25 4) *	3 6	2 5	2 4	1 0
60 yr and over						
Iason	175	78 (indir 53 7 dir 24 3) *	8 1	11 6	2 9	0 6
Redo (N Y H series)	827 †	71 (indir 50 dir 21) *	9 9	13 6	4 1	1 4

* Combined type (direct indirect) included with indirect group
† Primary hernias does not include recurrent cases (131)

common in the female than the male Postoperative ventral umbilical and epigastric hernias appear to be equally distributed between the sexes (see Fig 19 3) In Iason s small series of elderly patients there were but 3 females with indirect hernia as compared with 93 males There were no direct hernias in females in his cases while femoral hernias were almost four times more common in females than in males Postoperative ventral and umbilical hernias were equally distributed

A graph constructed from data of Zimmerman and Anson in 100 114 hernias shows the distribution of 1 000 unselected cases of hernia in the general population (Fig 19 4) This graph reveals that the sexual distribution of hernia in the aged parallels that in the younger age group In addition it points out again that in the aged there are more femoral and postoperative ventral hernias than in the general population, including all age groups

Distribution According to Side

Telle in a review of 1 694 cases of hernia encountered in a veterans hospital in patients from 19 to 84 years the majority between 20 to 60 years of age noted that femoral hernias were almost twice as common on the right side and inguinal hernias both primary and recurrent were also distinctly more common on that side Grace and Johnson in a group of 1 371 hernias in patients over 50 years (average age 57), reported 681 inguinal hernias on the right and 559 on the left In The New York Hospital series of patients over 60 years of age there were 315 inguinal hernias on the right 271 on the left Femoral hernias occurred slightly more than twice as frequently on the right as on the left (55 26) Thus so far as predilection for side is concerned hernias occurring in the aged follow the same pattern as those in the younger group Inguinal and femoral hernias tend to occur more often on the right than on the left

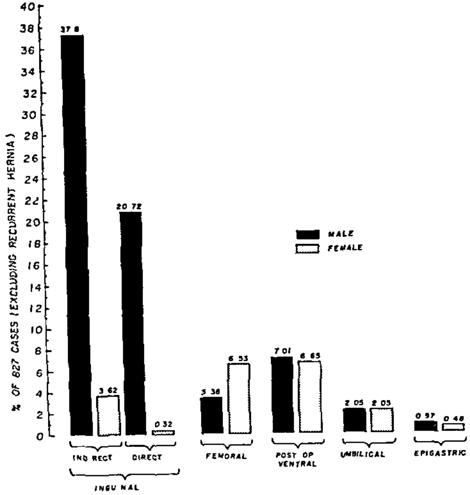


Fig 19 3 Bar graph indicating total number of various types of hernias and the sex distribution in patients 60 years and older at The New York Hospital (1932–1958) The figures do not include patients who had recurrent hernias

Incidence of Sliding Hernia

There was a total of 48 sliding hernias in The New York Hospital series of patients 60 and older These constituted 5 per cent of all inguinal hernias There were 28 (26 in males and 2 in females) in the 60 to 69 age group 17 (16 in males and 1 in a female) in the 70 to 79 and 3 (all in males) in the 80 to 89 age group Other workers reporting on patients in all age groups have indicated the incidences as 1 to 5 per cent (Table 19 3) The majority of writers list an incidence of 1 to 3 per cent Most of these hernias occurred in males There appears to be a slightly higher incidence of sliding hernia in older patients despite the data of

TABLE 19-3 INCIDENCE OF SLIDING HERNIA *

Authors	*Yr*	*Per cent*
Fallis	1936	3 3
Gibson and Felter	1930	3 1
Longacre	1939	3 1
Larsons	1937	3 7
Zimmerman	1953	3 0
Bevan	1930	1 0
Burton and Blotner	1942	1 0–2 0
Sensenig and Nichols	1955	4 9
Ryan	1956	5 0
Grace and Johnson (patients 50 yr and older)	1937	2 2
Redo (patients 60 yr and older)	1958	5 0

* Inguinal cases in all groups



Fig 19 4 Bar graph comparing the expected distribution of 1 000 cases of hernia in the general population (all ages) with the incidence in patients 60 years and older at The New York Hospital (1932–1958)

TABLE 19 4 PATIENTS ADMITTFD WITH STRANGULATED HERNIA

Ag yr	I guinal			Femor l			Post p vent al			Umbilic l			Ep gast ic			G d total		
	M	F	Tot l	M	F	Tot l	M	F	Total	M	F	Tot l	M	F	Tot l	M	F	Total
60–69	13[b]	?	15	9[d]	8	17	0	7	7	1		3	0	0	0			
0–79	11	2	13	4	14	18	4	3	7		4	6	0	0	0			
80–89	4[f]	0	4	0	0	0	0	0	0	0	0	0	0	0	0			
Total	8	4	3	13	22	35	4	10	14	3	6	9	0	0	0	48	4	90

The New York Hosp tal–C rnell M d cal Cent pat ts 60 yr d old 193 19 8
[b] Two h nias w r e rrent
O e p t ent d ed 7 d ys postoperati ly f b on hopn mon
[d] Two hern as w re urrent
O e patient di d 2½ h postope t vel f g rab d pe to tis at t m of surge y
[f] One h rn was urre t
[g] Seven her ias we e of th liding type

the two writers listed in Table 19 3 who en countered 4 9 and 5 0 per cent frequency in patients of all age groups The groups re viewed by Sensenig and Ryan, although including younger persons contained a preponderance of elderly patients

Incidence of Strangulation

In The New York Hospital series of 958 hernias 90 or 9 4 per cent were strangulated (see Table 19 4) There were 32 in guinal (28 in males and 4 in females) 35 femoral (13 in males and 22 in females) 14 postoperative ventral (4 in males and 10 in females) and 9 umbilical hernias (3 in males and 6 in females) This group of hernias is striking in that with the exception *of the inguinal variety the incidence of* strangulation in the females is approximately twice that in the males Interesting too is the fact that the greatest number were of the femoral variety There were no strangulated epigastric hernias

Age at Onset of Hernia

Of the patients 60 years or older reviewed *in The New York Hospital series (1932 to* 1958), 59 8 per cent of the hernias occurred after the age of 60 had been reached (Table 19 5) In the total of several series reported by Shelley there were only 150 cases of a group of 4 119 hernias that had onset after the age of 60 years Many of the hernias encountered in the aged are those that have probably been present since earlier in life The importance of this fact is that in a great number of instances correction of these hernias could be done before old age *is reached*

Diagnosis

Although the various types of hernias may differ to some degree in their clinical mani festations the most striking and constant objective finding is that of a mass or bulge This may be obvious or it may not be noted until the patient is made to cough or strain *The location of the mass in most instances* helps to determine the type of hernia A bulge in the inguinal region however may be a femoral rather than an inguinal hernia Since the femoral canal is relatively short and its boundaries are generally tough and unyielding as the hernia increases in size it may enlarge upward and lie over the inguinal ligament

The importance of establishing preopera tively whether an inguinal hernia is direct or indirect is debatable However a maneuver to help in this determination if the hernia

TABLE 19-5 AGE AT ONSET OF HERNIA *

Age gr	*Ig al*						*Femoral*		*P top ventral*		*Umbilic l*		*Ep ga tric*
	Ind		*D*		*Combi d*								
	P †	R †	P	R	P	R	P	R	P	R	P	R	P
0 9	1	0	0	0	0	0	0	0	0	0	1	0	0
10–19	0	0	0	0	0	0	0	0	0	0	0	0	0
20 29	2	1		0	1	0		0	1	0	0	0	0
30 39	8	1	5	[illegible]	1	0	0	0	4	0	4	0	0
40–49	40	3	11	4	4	0	11	1	7	0	4	0	1
50 9	77	13	56	14	18		10	3	[illegible]	[illegible]	11	0	
60–69	170	0	0	7	[illegible]	4	3	6	54	6	1[illegible]		5
0 9	36	3	4	9	9	1	18	0	18	1		1	1
80 89	3	0	1	0		0	1	0	0	1	0	0	0
U k w	6	0		4	5	0	3	0		0	0	0	3
T tal	*343*	*41*	*1 4*	*60*	*69*	*7*	*8*	*10*	*113*	*10*	*34*	*3*	*12*
T tal (in l ding re rrent h rn as)	84		34		6		9		1 3		37		19

* Th N w Y k Hosp tal Corn ll Medical Center
† P indi ates prim ry h r ia R ecurrent

is reducible, is to replace the mass hold the examining thumb over the internal ring and have the patient cough or strain If the hernia becomes apparent with the finger over the internal ring it is probably direct If the hernia does not reappear, it is probably indirect

Postoperative ventral and umbilical hernias are easily diagnosed except in very obese patients, where they may not be too readily apparent A postoperative hernia may underlie the scar of the previous incision or may be located a short distance from it Epigastric hernias are sometimes difficult to diagnose particularly when small and in obese patients Straining coughing and positioning may fail to bring them out In these instances however, there is usually tenderness to palpation immediately over the hernia This may be the only objective evidence of a small epigastric hernia in addition to its location For the actual techniques and methods of the steps in physical examination to aid in arriving at the diagnosis the reader is referred to general textbooks dealing with hernia

The *subjective complaints* of the patient with a hernia vary from acute cramping abdominal pain, often associated with nausea and vomiting in cases of strangulation to a dull ache heaviness discomfort or dragging sensation in uncomplicated cases Frequently with reducible hernias the patient is relieved of his discomfort by lying down and/or reducing the hernia Indeed because many patients are relieved by a truss they do not appear for surgical consideration until such time as the hernia has grown so large that it is no longer retained by the appliance

The diagnosis in cases of strangulated hernia is frequently similar to that in intestinal obstruction or peritonitis The usual steps in arriving at these diagnoses are taken and may include flat and upright films of the abdomen and barium enema in addition to routine laboratory studies including white blood cell count It must be remembered that often in the older age group the white blood cell count may not be significantly elevated even in the face of obvious infection The presence of an irreducible, tender hernial mass aids in making the diagnosis

In the differential diagnosis of hernia lipoma of the cord and hydrocele in the inguinal region should be ruled out a large saccular varix at the saphenofemoral junction must be borne in mind when a soft reducible femoral mass is encountered Lipomas of the abdominal wall especially in obese patients may be mistaken for postoperative ventral umbilical or epigastric hernias The differentiation, however is not usually difficult to make

Associated Conditions

In addition to hernia the patient over 60 years old is often beset with pathologic changes that are associated with the aging process These may complicate the repair, contraindicate various forms of anesthesia make the postoperative management difficult and predispose to recurrences The most commonly encountered associated conditions in the entire group of 958 hernias in The New York Hospital series were hypertension, arteriosclerosis pulmonary emphysema chronic bronchitis, obesity prostatic hypertrophy varicose veins diverticulosis and hemorrhoids With proper medical and anesthetic evaluation most of these conditions do not contraindicate surgical correction From the surgeons point of view however such conditions as chronic cough constipation or prostatism should be controlled or cured before surgery if the hernia is not to recur Of 619 male patients 134 had evidence of prostatic enlargement although this was symptomatic in only 53 It is to be expected that despite the absence of symptoms these patients are more apt to develop urinary retention postoperatively This may lead to straining and possible breakdown of the repair All patients with enlarged prostates should have careful urologic evaluation prior to surgery If residual urine is great it may be necessary to correct the prostatic problem before the hernia is re

paired In The New York Hospital series 37 patients had prostatic resection or removal prior to herniorrhaphy An additional 14 required prostatic removal in the immediate postoperative period because of urinary difficulties

Chronic cough or constipation should be corrected or alleviated prior to surgery and for as long as possible thereafter Heavy lifting and abnormal stretching or straining should be avoided for 8 to 10 weeks postoperatively in order to allow for best possible wound healing

Cardiovascular diseases in the aged group were very common occurring to some degree in 544 patients Of these 202 had evidence of arteriosclerotic changes 162 had hypertension and 180 had both arteriosclerosis and hypertension Because of this careful anesthetic evaluation is necessary Many older persons may be receiving antihypertension drugs These must be discontinued for a suitable period preoperatively even if a local anesthetic is to be used

Not only are the associated conditions important from the point of view of possible *recurrence of the hernia but they may contribute* to complications These include urinary and respiratory difficulties thromboembolic phenomena and accidents In this latter group slight disorientation or a mild syncopal attack may lead to a fall in which the patient may sustain a fracture contusion laceration or serious head injury This occurred in two instances in The New York Hospital series In one instance a 66 year-old male had had emergency repair of a strangulated inguinal hernia He was begun on a progressive ambulation regimen on his first postoperative day While in a wheel chair he arose for an instant and fell striking his head on the floor He sustained a fractured skull and a subdural hematoma In the second instance a 75 year old male underwent an uneventful inguinal hernioplasty and did well postoperatively Ambulation was begun on the first postoperative day On the fourth postoperative day he fell and sustained a fracture of the hip This was treated by open reduction and internal fixation

Sudden death may occur occasionally in the older age group because of coronary artery disease One 74-year old male patient in The New York Hospital series died suddenly while doing well postoperatively Death occurred on the sixth postoperative day This patient was seen on rounds at 4 30 P M and was up and about without difficulty About one hour thereafter he was found in bed cyanotic and moribund He died 1 hour later despite all measures A massive coronary occlusion was found at postmortem examination

Bronchopneumonia caused two deaths in The New York Hospital series These occurred 7 and 17 days postoperatively Both patients had been treated with antibiotics Postmortem lung cultures grew out hemolytic *Staphylococcus aureus*

One patient died of a massive pulmonary embolus on the seventeenth postoperative day This patient had not had a history of varicose veins or of thrombophlebitis or phlebothrombosis In The New York Hospital group *93 patients were noted to have* varicose veins In these cases Ace bandages should be applied on the morning of operation and maintained until the patient is completely ambulatory In closing this section it should be mentioned that in this group of patients carcinoma may be present although symptomless Because of this if the type of hernia encountered enables the surgeon to perform exploration of the abdomen this should be done In four cases in The New York Hospital group carcinoma became apparent 1 to 8 months after hernia repair Two patients had ventral hernias but repair was accomplished without exploration A third patient had an inguinal and the fourth an epigastric hernia Obviously abdominal exploration in an inguinal femoral or epigastric hernia is not usually possible However where there is a large umbilical or a postoperative ventral hernia exploration can usually be performed Although only a few cases of malignancy may be found in this



Fig 19 5 X ray photograph of barium enema in an 80 year old male patient with large scrotal hernias bilaterally There is an irregular narrowed area in the sigmoid in the hernia on the left which was due to carcinoma

way it is, nevertheless, a procedure to be done whenever and wherever possible in this group of elderly patients

An example of this is a 67 year old male who was admitted with postoperative ventral hernia in a right upper rectus scar of a previous cholecystectomy Exploration at the time of repair revealed an annular constricting carcinoma of the transverse colon This was resected and the hernia repaired without incident

In some instances carcinoma may be present in the hernia This occurred in a 75 year old female admitted with a large left femoral hernia When the sac was opened carcinoma established by frozen section examination of tissue was discovered A 67 year old male was found to have carcinoma of the sigmoid in an irreducible left indirect inguinal hernia The sac was incised to reduce the hernia Because of liver metastases in both these patients repair of the hernias was not carried out

A third patient an 80 year old mal entered the hospital with a 9 month histo of rectal bleeding He uge scrotal hernias bilaterally Barium enema revealed carcinoma of the sigmoid in the hernia on the left (Fig 19-5) He had sigmoid resection and repair of his hernia at the same time and recovered without incident If carcinoma is detected in the hernia treatment of the malignancy has priority Repair of the hernia may be performed concurrently if the patient s condition allows or may be postponed indefinitely

Treatment

Except in patients where surgery is contraindicated because of extremely poor general health operation is the only method of treatment for all types of hernia The injection treatment for inguinal hernia practiced by some in the 1930s as well as earlier, has been shown to be inadequate Maier in a short paper on the subject concluded his discussion ' we have come to the definite conclusion that the injection treatment has no place in the treatment of hernia and its use should be condemned

One patient in The New York Hospital series a 65 year old female with a right indirect inguinal hernia had been treated elsewhere by injections over a period of 6 years Despite these treatments the hernia persisted and she underwent inguinal herniorrhaphy There was much scarring and fibrosis and the sac was freed with much difficulty Two loops of small bowel in the hernia were densely adherent It was apparent that the sclerosing agent had been injected into the intestine since there were tumorlike nodules on the bowel wall An anatomic repair was done with silk The patient made an uneventful recovery and did not have a recurrence when last seen 3 years postoperative

In those elderly debilitated patients too ill to undergo operation a properly fitting truss is the only available substitute for surgical correction In these patients the truss ave some justification but in all other ns it does little good if any and may

Occasionally there may be an extremely obese patient with a large postoperative ventral hernia In this instance, weight reduction is important and unless there is evidence of strangulation operation should be deferred until there has been weight loss It may be necessary to hospitalize such patients in order to maintain them on a limited food intake *Returning a large hernial mass back* into the abdomen after many years of separate living may cause respiratory embarrassment due to elevation of the diaphragm Applying a tight binder and keeping the patient in bed with the foot of the bed elevated may tend to simulate conditions after reduction but this is not actually the case A technique described by Koontz that may be a good preoperative adjunct to surgery is pneumoperitoneum In applying this method air is injected into the abdominal cavity at a site well away from the hernia in order to prevent encounter with bowel adherent to the peritoneum Koontz advocated the linea semilunaris of Spigelius as a good site as there is a heavy fascia there and a definite give is felt as the needle goes through the fascia and enters the peritoneal cavity A No 19 lumbar puncture needle is used with a two way stopcock attached to a large syringe Air is injected until the patient has slight respiratory distress As a rule 500 to 1 000 cc can be instilled the first time Additional injections are given 2 to 5 days apart until it is felt that the abdominal cavity has become enlarged enough to accommodate the contents of the hernia sac At subsequent injections as much as several liters of air can be injected at one time An abdominal binder is worn throughout the period of injections in order to prevent the air from simply becoming captive in the hernia sac and not enlarging the peritoneal cavity Ten days to 3 weeks should be sufficient time to prepare the patient for operation Although the patients are usually kept in the hospital during the period of injections the method can be used on an outpatient basis Pneumoperitoneum causes elevation of the diaphragm and general stretching of the abdominal cavity Thus when the hernia is replaced it returns to an enlarged space which is better able to accommodate the newly returned viscera

Care must be taken in reducing a large postoperative ventral hernia Respiratory function studies should be made preoperatively *in order to evaluate the patient s pulmonary reserve* It is not impossible for death to occur due to respiratory embarrassment in the immediate postoperative period If difficulty with respiration is noted immediate operation with release of the repair is indicated

SPECIFIC HERNIA TYPES

Indirect Inguinal Hernia

An *indirect* inguinal hernia is one that emerges from the internal ring and descends into and through the inguinal canal exiting through the external ring It may descend into the scrotum The hernia arises lateral to the deep epigastric vessels The sex and age incidence have been covered in the section on Incidence above

Repair

In general the types of repair may be classified according to whether or not the cord is transplanted The cord may be transplanted beneath the external oblique aponeurosis (Bassini) or subcutaneously (Halsted I) If the cord is not transplanted it may be left in its usual location (Ferguson) or it may be drawn up under the internal oblique (Halsted II) McVay and Anson in 1942 described a repair in which the aponeurotic lower margins of the transversus abdominis and internal oblique muscles are sutured to Cooper s ligament The cord is then dropped onto this and the external oblique aponeurosis sutured over this so that the cord emerges at the site of the external ring The obliquity of the canal is thus restored In 1949 these writers published a

review of 100 cases in which this operation had been carried out with good results As reported at that time, however, the technique differed from the earlier description in that *after ligation of the sac the fascial margins* of the internal ring are identified, the cord retracted laterally, and the ring snugly closed medial to the cord by one or two mattress sutures Sutures are then taken through the transversus aponeurosis and fused transversalis fascia above and Cooper s ligament below The third from last suture is placed close to the femoral vein, the next to last passes deeply into pectineus fascia below, and the last one includes transversalis fascia above and the anterior layer of the femoral sheath at its medial extremity below

Zimmerman has criticized the McVay concept and has pointed out (1) that the mobility of the inguinal ligament is not a serious objection to its utilization in repair since failures related to the mobilization of the inguinal ligament would appear as femoral recurrences a type of recurrence rarely seen (2) that insertion of sutures into Cooper s ligament is difficult and hazardous in terms of possible injury to the femoral vein and (3) that these sutures into Cooper s *ligament cannot be carried far enough* lateral to protect the entire area of Hesselbach s triangle The reader is referred to the articles by McVay and the textbook of Zimmerman for a more thorough description of the operative procedure including a new method devised by Zimmerman

In cases of small indirect hernias with a relatively strong inguinal floor the author prefers merely to strengthen the internal ring by imbrication of the transversalis fascia and the placement of a suture within the ring in the manner of a purse string to gather the fascia of the cord at several points approximating it to the transversalis fascia above as suggested by McVay and then merely reapproximating layers that had been opened in normal anatomic fashion However, in most instances in the aged the hernia is large and the inguinal floor is weak Thus usually every effort is made to repair the hernia and strengthen the inguinal floor especially in the region of Hesselbach s triangle A Cooper s ligament type of repair with transplantation of the cord in the Halsted manner is probably the best method to strengthen this medial angle

Direct Inguinal Hernia

A direct hernia is one that arises through Hesselbach s triangle medial to the epigastric vessels For this variety of hernia the repairs indicated above with the exception of simple imbrication of the internal ring are quite satisfactory The best method probably is the Cooper s ligament repair de

TABLE 19 6 TYPES OF OPERATIONS PERFORMED FOR INGUINAL AND FEMORAL HERNIAS *

Age yr	*Inguinal hernia (all varieties) type of repair*					*Femoral hernia (all varieties) repair in relation to inguinal ligament*		
	Anatomic (Ferguson)	*Bassini*	*Halsted*	*McVay*	*With orchiectomy*	*Above*	*Below*	*Combined*
60–69	76	19	373	28	9	50	7	2
70–79	13	2	133	9	10	26	5	0
80–89	1	0	18	0	3	2	0	0
Total	90	21	524	37	22	78	12	2

* The New York Hospital–Cornell Medical Center patients 60 yr and older 1932–1958

TABLE 19-7 INCIDENCE OF RECURRENCES AFTER SURGERY *

Age, yr	Inguinal (all varieties) type of repair						Femoral (repair in relation to inguinal ligament)				Postop ventral			Umbilical			Epigastric		
	[illegible] (Ferguson)	Halsted	Bassini	McVay	Sex M	Sex F	Above	Below	Sex M	Sex F	Total	Sex M	Sex F	Total	Sex M	Sex F	Total	Sex M	Sex F
60-69		8	2	3	35 †	0	7	1	4	4	11	7	4	2	1	1	0	0	0
70-79	0	6	0	1	9	0	4	0	3	1	10	7	3			0	0	0	0
80-89	0	1	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0
Total (including recurrent hernias) ‡	2	37	2	4	4	0	11	1		5		14	8	4	3	1	0	0	0

* The New York Hospital–Cornell Medical Center patients 60 yr and older 19[illegible] 19[illegible]

† T[illegible] h[illegible]d bilateral recurrences.

‡ Total recurrences by type were as follows inguinal, 4[illegible] femoral 12 postop ventral, [illegible] umbilical, 4 epigastric, 0 Grand total of recurrences was 83 Per cent of recurrence was 8 66 per cent (83 out of 9[illegible]8)

scribed by McVay Zimmerman repairs direct hernias by suturing transversalis fascia to the inguinal ligament He then creates a flap from the medial portion of lateral leaf of the external oblique aponeurosis and sutures this over the transversalis fascia for reinforcement while the internal oblique muscle is elevated and retracted The lateral edge of the remainder of the lateral leaf of the external oblique aponeurosis is then imbricated beneath the medial leaf of the external oblique aponeurosis over the cord The medial flap is then sutured down to the shelving border of the inguinal ligament over the cord Zimmerman has used this technique for several years with satisfactory results This method might be improved upon by suturing the medial flap to the inguinal ligament beneath the cord thus providing another tough fascial layer to strengthen the inguinal floor

One last method of repair of inguinal hernias in the male should be mentioned since it is apt to be very applicable in the old age group That is the correction of the hernia by means of removal of spermatic cord with or without orchiectomy This should be reserved for instances where adequate abdominal wall reconstruction is impossible without sacrificing the cord or where there have been one or more recurrences after conventional methods of repair The sacrifice of a cord and testis in this older age group is perhaps preferable to the hazards of repeated surgery

The types of repair used in the older age group reviewed at The New York Hospital were as indicated in Table 19 6 The Halsted I type of procedure was used in 72 4 per cent of the cases

The number of recurrences can be seen in Table 19 7 In the primary inguinal hernia group there were 38 recurrences in a total of 694 operations an incidence of 5 48 per cent These all occurred in males There were 28 patients 60 to 69 years of age 9 in the 70 to 79 range and 1 over the age of 80

The greatest number of inguinal hernias were repaired following the Halsted method and it is after this type of operation that there was the greatest number of recurrences Thus of a total of 373 repairs of this type in the 60 to 69 age range (including recurrent hernias that were repaired) there were 28 recurrences The percentage of recurrences by age groups considering all types of inguinal hernias and all types of repairs is indicated in Table 19 8

In the series reported by Telle recurrences all age groups considered amounted to 10 8 per cent The Bassini method of repair was used most frequently in his cases with a 10 5 per cent recurrence rate The McVay method used one third as often led

TABLE 19 8 PERCENTAGE OF RECURRENCES OF INGUINAL HERNIAS

Age yr	*No of hernias*	*No of recurrences (all types)*	*Recurrences %*
60-69	505	35	6 9
70-79	167	9	5 4
80-89	22	1	4 5
Total	*694*	*45*	*6 5*

to a 14 4 per cent recurrence rate, while the Halsted technique, used in only 88 of 1,124 hernias resulted in 13 9 per cent recurrences

In a series of 500 cases reported by Glenn and McBride encompassing all age groups the total number of recurrences of inguinal hernia (all types) was 14 of 305 cases followed an over all recurrence rate of 4 5 per cent A second paper on the subject by Glenn in 1947, revealed 51 recurrences in a total of 931 cases of all types of inguinal hernia followed a recurrence rate of 5 5 per cent In the series of patients over 50 years of age, reported by Grace and Johnson, there were 1 240 inguinal hernias of all types, with 330 recurrences a recurrence rate of 26 5 per cent The larger groups reviewed in which there has been follow up of at least more than 1 year report a recurrence rate for all types of inguinal hernia from 2 0 to 15 per cent, with the average figure somewhat less than 10 per cent These include patients of all ages In Iason s small series of aged patients the recurrences are not mentioned The New York Hospital series of patients over 60 years of age, as indicated above, had an over-all inguinal hernia recurrence rate of 6 5 per cent This is four times lower than that reported by Grace and Johnson for patients over 50 This discrepancy cannot be explained However, The New York Hospital figures indicate that the recurrence rate in the aged is not significantly higher than that which includes patients of all ages reported from the same institution The striking thing is that all the inguinal recurrences occurred in males This emphasizes the role of the spermatic cord in preventing a good repair Where large, it should be thinned out when the repair is done to only its significant elements namely, vas deferens spermatic artery, and some spermatic veins Type of suture material in this series does not appear to play a significant role, since all the recurrences were in repairs accomplished with silk In only one instance was there an inguinal recurrence following wound infection The interval between operation and recurrence is represented in Fig 19 6 There were 30 recurrences within the first 3 year follow up period for an incidence of 69 8 per cent An additional 9 recurred within the next 2 years for an incidence of 20 9 per cent Thus within the first 5 years occurred 39 of the 43 recurrences or 90 7 per cent In a series reported by Clear time until recurrence of inguinal hernia in all age groups was indicated as 33 per cent recurrence within the first 3 years, 62 per cent within the first 5 years, and 100 per cent within 10 years The writer included a table with figures taken from Burdick (repair by autogenous homogenous or ox fascia) showing 60 per cent of the recurrences within 2 years and 100 per cent of the recurrences within 3 years The use of fascia a suture material rarely used today, makes these figures less valuable for comparison Erdman reported 73 9 per cent of recurrences within the first year and 98 6 per cent of recurrences within 2 years

Telle reported 42 6 per cent of recurrences within the first 2 years and 100 per cent within the first 5 years These values are very close to those in The New York Hospital series (48 8 per cent within 2 years 90 7 within 5 years) The figures indicate that if follow up is for 2 years only 40 to 50 per cent of recurrences will be discovered If follow up is for 3 years, about 70 per cent of recurrences will be noted For correct recurrence values however the follow up period should be 5 years since in this interval at least 90 per cent of recurrences will have

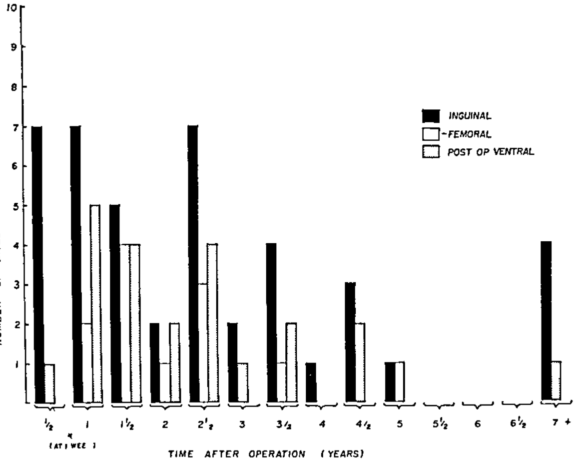


Fig 19 6 Bar graph indicating the time interval between hernia repair and recurrence in patients 60 years and older at The New York Hospital (1932–1958)

taken place There does not seem to be any great difference in this regard between the aged and the general population

Sliding Hernia

This may be defined as an inguinal type of hernia in which a portion of one wall of the sac is composed of a viscus that is normally only partly covered by peritoneum The bowel is not in the lumen of the hernial sac but usually makes up its posterior wall This consists most commonly of the cecum on the right and the sigmoid on the left The bladder may also be included in sliding hernia Although sliding hernias may be direct or in rare instances femoral (containing bladder usually) the most common form occurs as an indirect inguinal hernia Most writers generally agree that the incidence of this type of hernia increases with age In The New York Hospital series of patients over 60 years of age the sliding hernias have been included in the statistics of inguinal hernia in general There was a total of 48 sliding hernias 37 indirect 8 direct and 3 combined 45 occurred in males 3 in females The incidence of sliding hernia in the group was 5 per cent of all types of hernias The incidence reported by several workers for all age groups is indicated in Table 19 3 The average is about 3 1 per cent when all age groups are included The series of patients 50 years and older reported by Grace and Johnson had a lower incidence 2 2 per cent In the small group of patients 60 years and over reported by Iason there were 11 sliding hernias in a total of 135 inguinal hernias an incidence of 8 1 per cent This compares with an incidence of 6 9 per cent of all types of inguinal hernias

in The New York Hospital series of patients over 60 years of age

The diagnosis is difficult to make preoperatively, but a large hernia that has descended into the scrotum and that has been irreducible for many years should make the examiner suspect a *sliding hernia* *This is* important because the sac must be more carefully dissected out and the opening into *it must be* made at its most anterior and superior aspect in order to avoid entering the viscus which makes up the posterior wall

Treatment

Treatment is surgical Three techniques may be employed in the approach to the repair of the sliding hernia These all have to do with the management of the sac particularly the sliding component that makes up the posterior wall A brief description of each type will be given The reader is referred to books on surgical technique for more detailed instructions

One method of dealing with the sliding component is that proposed by Hotchkiss In this procedure the peritoneum is cut along both sides of the mesenteric attachment of the bowel The blood supply of the colon should be carefully preserved The cut peritoneum bordering the bowel is then sutured together behind the bowel thus forming a mesentery The rent in the wall of the hernia sac created by incising the peritoneum close to the bowel is next closed, thus forming an intact peritoneal posterior wall of the hernia sac The reperitonealized bowel is then replaced into the abdomen The now completely peritoneum lined hernia sac is closed with a suture ligature and the redundant portion excised

A second method of handling the sliding component is that described by Moschcowitz (1925) The free peritoneal cavity is entered above the internal ring either by separating the fibers of the internal oblique at the upper end of the extended hernial incision or in very large hernias by a midrectus incision Next traction is applied above the prolapsed bowel and the hernia reduced When this is done, the incision in the anterior wall of the hernia sac becomes a mere slit which may be closed with a few sutures *The segment of bowel is held in its normal* position and anchored to the posterior abdominal wall by sutures Care must be taken *on the medial side to avoid injury to blood* vessels or ureter

A third method, described by Zimmerman and Laufman consists in replacing the reducible portion of the sliding component to the abdomen A purse string suture is then placed about the neck of the sac extending as high on the anterior surface as possible and on the posterior side as close as is safe to the reflection of the peritoneum onto the colon As this suture is pulled together the bowel is turned upward and the sac is closed The sac with its contained intestinal floor is then dissected from the cord structures in a manner similar to that employed in non sliding hernias This dissection must be carried well into the abdominal cavity

In each instance after the sliding component has been disposed of repair continues as for any other inguinal hernia Burdick and Higginbotham have advocated division of the spermatic cord in this type of hernia dropping the central end into the preperitoneal space and completely closing the canal This is probably a worthwhile maneuver in very large and difficult hernias which involve the internal ring especially in the very aged with intercurrent diseases for subjecting these patients to more than a single operative procedure may be hazardous In The New York Hospital older age group all three methods of dealing with the sliding component were used The number of cases in which each type was used are too small to be of significance in evaluating the merits of one technique over another There were three recurrences in this group for a rate of 6 25 per cent Zimmerman reported no recurrences in a group of 24 cases treated by his method described above Sensenig and Nichols reported a 13 per cent

recurrence rate following use of the Hotchkiss method Ryan using a method similar to that of Zimmerman and Laufman reported 1 per cent recurrence Grace and Johnson in the series of patients 50 years and older had four recurrences in a group of 20 patients followed for a recurrence rate of 20 per cent The repair was that described by Hotchkiss

The number of cases of sliding hernia is small and the surgical techniques variable Comparison of recurrence figures is therefore difficult to interpret The results from The New York Hospital group and the series of Grace and Johnson suggest that the recurrence rate in this type of hernia may be higher in the older age group than in the population as a whole

Femoral Hernia

A protrusion of properitoneal fat omentum or a portion of an intraabdominal viscus through the femoral canal constitutes a femoral hernia As mentioned in the section on Incidence it is about two times more common in females than in males over 60 years

The diagnosis is established by detecting a mass that protrudes from below the inguinal ligament Femoral hernia is frequently misdiagnosed as inguinal In 35 cases of a total of 92 femoral hernias in The New York Hospital group of patients 60 years or older symptoms and signs of strangulation were the immediate antecedents to hospital admission In these instances emergency correction was performed

Treatment

Use of a truss in these hernias is not feasible in most instances since many of them are irreducible and also because of the location of the femoral canal deep to the inguinal ligament The treatment of femoral hernia is surgical and is aimed at obliteration of the femoral canal

Zimmerman stated that over 100 procedures have been devised for the correction of femoral hernia, indicating that probably none is entirely satisfactory The major methods of surgical correction are the following

1 Procedures from above the inguinal ligament

2 Procedures from below the inguinal ligament

3 *Procedures performed with a combined approach from above and below*

More and more surgeons are performing the repair from above and in more difficult cases using incisions above and below the inguinal ligament The approach from above provides better exposure and should bowel resection be necessary in cases of strangulation it is better done through this incision

The operative technique in brief consists in resecting the sac and obliterating the femoral canal by suturing the inguinal ligament down to the pectineal fascia McVay described a technique in which the femoral sac is converted into a direct hernia The hernia is then repaired by suturing the cut edge of the posterior inguinal wall to Cooper s ligament up to within a few millimeters of the femoral vein This reconstructs a normally attached posterior inguinal wall and closes the femoral ring A transition suture is then placed through the fragmented anterior femoral sheath and pectineal fascia to the posterior inguinal wall This suture not only reestablishes the medial wall of the femoral sheath but is necessary to close the angle between the level of Cooper s ligament and the more superficial anterior layer of the femoral sheath The transversalis fascia is next approximated to the anterior layer of the femoral sheath The operation performed from above is completed by closing the external oblique aponeurosis over the cord (or round ligament of the uterus) and the subcutaneous fascia and skin are sutured as for inguinal hernias

The above below technique enables better mobilization of the hernia when the sac is stuck down The lower incision merely facilitates freeing of the sac The actual re

pair is performed usually from the upper aspect

In The New York Hospital series of patients 60 years and older, there are 82 primary femoral hernias, 54 in females and 28 in males There were 10 recurrent femoral hernias, bringing the total of this type of hernia to 92 This was 9 9 per cent of all the primary hernias encountered, or 9 6 per cent of all the hernias, including recurrent, in this series Iason, in his series of 175 patients over the age of 60, reported 14 femoral hernias, 11 in females and 3 in males Thus in his cases, femoral hernias made up 8 per cent of the entire group A comparison of these figures with the incidence of femoral hernia in the population as a whole has been made in the section on Incidence In general the incidence of femoral hernia is higher in the older age group

The types of operations performed at The New York Hospital in the patients 60 years and older for correction of femoral hernia (including recurrent hernias) are listed in Table 19 9

The repairs were performed with the use of chromic catgut in two cases stainless steel wire in three instances and silk in all others Recurrences encountered were as indicated in Table 19-10

There were 12 recurrences 7 in males and 5 in females in the entire group of 92, for a rate of 13 per cent

In Telle s series in which all ages were considered the recurrence rate for femoral hernia was 22 per cent

In a series of 1,545 hernias reported previously from The New York Hospital by

TABLE 19 9 NUMBER OF OPERATIONS IN RELATION TO INGUINAL LIGAMENT

Age yr	Above	Below	Above and below
60-69	50	7	2
70-79	26	5	0
80-89	2	0	0

TABLE 19 10 NUMBER OF RECURRENCES RELATED TO TYPE OF OPERATION ORIGINALLY PERFORMED

Age yr	Above	Below	Total
60-69	7	1	8
70-79	4	0	4
80-89	0	0	0

Glenn (1947) in which 94 patients with femoral hernias were followed there was a recurrence rate of 8 5 per cent In the group of patients over 50 years of age reported by Grace and Johnson, there were but 28 femoral hernias followed, with a recurrence rate of 3 5 per cent This is a much lower value than reported elsewhere and is probably due to the small number followed Comparing Glenn s figures from The New York Hospital on patients of all ages with data on The New York Hospital patients 60 years and older, the recurrence rate in the elderly group is 13 per cent compared with 8 5 per cent

The interval between operation and recurrence is indicated in Fig 19 6 Ten of the twelve recurrences developed within the first 3 years (83 per cent) The remaining 2 recurred within the next 2 years All the recurrences were manifest within 5 years

Postoperative Ventral Hernia

These are the hernias that follow operative incision and division of the abdominal wall The diagnosis is made by detecting a hernial bulge beneath or adjacent to a previous surgical scar

In the group of patients 60 years and older encountered at The New York Hospital from 1932 to 1958 there were 113 primary and 10 recurrent for a total of 123 postoperative ventral hernias The incidence of males to females was approximately 1 1

Treatment of these hernias is preferably operative They tend to become larger and as they do the size of the musculofascial defect increases making repair more and

more difficult The ideal in this type of hernia is to prevent its occurrence The poorer structures of the abdominal wall in the older age group make it imperative that, following any incision a meticulous layer closure with good approximation of all structures and careful attention to placement of sutures to prevent strangulation and necrosis of tissue be carried out In addition irrigation of the subcutaneous portion of the wound to remove loose bits of fat and fragmented tissue should be performed to prevent the accumulation of materials that may serve as a nidus of infection Obliteration of dead space in the wounds is also of importance Good preoperative evaluation and preparation of the elderly patient in regard to nutritional state anemia electrolyte concentration and proper vitamin status will contribute to a smooth postoperative convalescence and prevention of postoperative ventral hernia

Treatment

The type of operative repair depends largely upon the size and location of the hernial defect Wherever possible the area of the hernia should be looked upon as and converted into a fresh surgical incision which is then to be closed in an anatomic layer fashion

The old scar should be excised care being taken not to injure the sac or its contents which are usually firmly adherent to the undersurface of the scar Dissection is then continued until intact fascia is freed around the circumference of the hernia Sharp dissection gentle handling of tissues careful hemostasis and meticulous asepsis should be practiced in carrying this out since most of the dissection is in the subcutaneous tissue where resistance to infection is minimal With smaller hernias after the fascia has been identified the sac can be opened the redundant portion excised and a careful layer to layer repair done If the hernias are large however or tissues are of poor structure or the layers are not well defined an imbrication type of procedure may be carried out If the long axis of the defect is horizontal an overlapping from above downward can be employed If the defect is vertical overlapping from side to side will probably be the better procedure Some surgeons prefer to use an extraperitoneal technique in which the repair is accomplished by turning in the unopened hernial sac and approximating the fascial edges in two layers the innermost of which consists of the thickened edge of hernia sac on either side and the outer one the edges of the anterior rectus sheath

In most instances patients about to undergo repair of relatively large postoperative ventral hernias should have nasogastric or long intestinal tubes inserted immediately preoperatively in order to keep the stomach and small bowel suitably decompressed following surgery until such time as normal bowel activity is resumed In this way abdominal distention with possible breakdown of the hernia repair may be prevented

The use of inert materials for the correction of hernia defects when there is an apparent deficiency of the patient s own tissues has been practiced by some Maier decried the indiscriminate use of these materials indicating that recurrences often with draining sinuses are prone to occur Dales and Kyle (1958) reported on 38 patients with 40 hernias repaired by the use of tantalum gauze all of whom were followed more than 5 years In the inguinal group in which there were 30 hernias 2 patients had recurrences and in 2 sinus tracts developed Four of six incisional hernias and 1 of 4 umbilical hernias recurred A study of the x ray films of the implants in 37 patients revealed that after some months fatigue fractures began to appear After 3 years all the implants were fractured There were fractures of the implants often with wide separation of the fragments in all the patients in whom recurrences were noted The writers concluded that fragmentation could be of practical importance in that the pieces might penetrate into the peritoneal cavity and intestinal walls

In The New York Hospital aged series there was one patient a 70 year old male who had had a ventral hernia repaired elsewhere with tantalum mesh When seen at The New York Hospital he had a recurrence of his hernia of 2 year s duration At the time of the second repair the mesh was found to be fragmented The pieces of prosthesis were removed, and a vertical overlap repair making use of the patient s own tissues and silk sutures was performed There has been no evidence of recurrence after 1 year follow up With the development however, of new plastic materials and broader experience with their use in the body it is not unlikely that continued experimental work in this field may lead to the production of a nonreactive material that will be suitable for replacing large segments of the abdominal wall when they are absent or obviously deficient

The most striking or constant element in the development of postoperative ventral hernia is wound infection Of the 123 cases of this type of hernia in The New York Hospital group of patients 60 years and older 28 had had wound infection following their original surgery after which the ventral hernia developed

In the group operated on at The New York Hospital repair was accomplished with silk in 80 stainless steel in 36 and chromic catgut in 7 cases There were 22 recurrences a rate of 17 9 per cent Five of these had a second repair in 2 of which there was a second recurrence The list of recurrence by age groups is indicated in Table 19 11

TABLE 19 11 POSTOPERATIVE VENTRAL HERNIAS

Age yr	No of recurrences	Recurrence after 2d operation
60-69	11	2 (both recurred 2 yr after 2d operation)
70-79	10	0
80-89	1	0

* Five recurrences were in patients who developed wound infections immediately after initial repair

In the group of all ages reported by Glen (1947), there was a 12 per cent recurrence rate

The interval between operation and recurrence is listed in Fig 19 6 There were 17 recurrences within the first 5 years (95 4 per cent)

Five of the recurrences (23 7 per cent) occurred in patients who had a wound infection postoperatively and occurred months, 7 months 1 year 6 months 1 yea 9 months and 2 years 10 months respectively, after initial surgery The recurrence rate is higher in the older aged patients than in younger individuals

Umbilical Hernia

This may be defined simply as the protrusion of abdominal content through the umbilical ring The diagnosis can be made usually by inspection or palpation alone These hernias occasionally become strangulated and may require emergency correction They are often seen in patients with ascites due to cirrhosis or cardiac decompensation and because of this, may be found in the older age group However the incidence in patients over 60 years of age at The New York Hospital was 4 1 per cent as compared with incidence in all age groups of 8 to per cent This higher value is probably the result of the large number of umbilical hernias in childhood The incidence of this type of hernia in the age range of birth to 10 years has been reported by Shelley as 39 3 per cent

Treatment

The treatment of umbilical hernia in the elderly patient as in other age groups is surgical This may be accomplished more easily and securely in most individuals by excision of the umbilicus However this need not be sacrificed in every instance In any case after making the incision through skin and subcutaneous tissue the dissection is carried down to the intact rectus sheaths surrounding the hernia After these are cleared of overlying fat the sac is opened

and the redundant portion excised after the hernial contents have been reduced. Closure of the defect by the imbrication technique is the method of choice. The peritoneum and rectus sheaths are dealt with as a single layer. Interrupted mattress sutures (usually of silk) are used to imbricate the upper flap over the lower. All of the sutures are placed first before any are tied down. A second row of sutures is then placed in simple interrupted fashion to unite the edge of the upper flap to the rectus sheath somewhat below the edge of the lower flap. In this way a two-layer closure of peritoneum and rectus sheath is obtained.

In the group of patients 60 years and older at The New York Hospital, there were 37 umbilical hernias, 3 of which were recurrent, 18 in males and 19 in females. The age distribution is indicated in Table 19-12.

The type of suture material used to effect the repair was silk in 32, stainless steel in 3, and chromic catgut in 2 cases.

There were four recurrences. These all occurred within the first 2 years. Silk had been the suture material used in each instance. The earliest occurrence was within 6 months, the latest just after 2 years. One of the recurrences was in a patient who had had a wound infection immediately after operation. Two of the recurrences were secondarily repaired and were intact 5 years and 1 year after surgery. Three of the recurrences were in males, one in a female.

The recurrence rate in The New York Hospital patients over 60 years of age is 10.8 per cent. Simmons, considering all age groups, reported a recurrence rate of 10 per cent with the use of the Mayo method and 22 per cent with other methods.

Glenn (1947), reviewing The New York Hospital group including all ages, reported a recurrence rate of 11.8 per cent. The incidence of recurrence of umbilical hernia in the older age group is about the same as that for the population in general.

TABLE 19-12. DISTRIBUTION OF UMBILICAL HERNIAS IN PATIENTS 60 YEARS AND OLDER

Age, yr	No. of hernias	No. of recurrences
60–69	25	2
70–79	12	2
80–89	0	0

Epigastric Hernia

These are defined by many as hernias through the linea alba occurring anywhere between the xiphoid process and the umbilicus. Although diagnosis may be simple if the hernia is perceptible on inspection or palpation, frequently localized tenderness may be the only diagnostic sign.

The incidence of this type of hernia in patients 60 years and older reviewed at The New York Hospital was 1.25 per cent of all hernias. In a series reported by Glenn comprising all age groups at The New York Hospital, the incidence was 0.8 per cent. Other series give a range of 0.4 to 3.6 per cent with an average of 2 per cent. These values are for all age groups. In the series of patients over 50 years old reported by Grace and Johnson, there was an incidence of 1 per cent. Thus, the incidence of this type of hernia is not greater in the aged than in the total population.

Treatment

The treatment of epigastric hernia is surgical. An incision is made over the mass, and the subcutaneous tissue is dissected off the hernia and the surrounding linea alba. The hernia is usually irreducible and firmly adherent, so the linea alba must be incised in order to accomplish reduction. A small lobule of fat may be simply pushed in, but a larger mass must be inspected carefully to determine the absence or presence of a peritoneal sac. If there is one, it should be opened and explored and its contents released and returned to the abdomen. The redundant sac should be excised and the opening closed by suture. Closure of the de-

fect in the linea alba is accomplished by simple suture or by imbrication There were 12 epigastric hernias in The New York Hospital series of patients 60 years and older 8 in males and 4 in females Repair was accomplished with silk in 10 and with chromic catgut in 2 cases There were no recurrences In Glenn s earlier review of The New York Hospital cases of all ages, there was one recurrence in a group of 11 patients followed for a rate of 9 per cent This is an inordinately high value attributable to the small number of patients involved

Recurrent Hernia

In the series of patients 60 years and older encountered at The New York Hospital there were 131 recurrent hernias These were distributed as follows indirect inguinal 41 direct inguinal 60 combined inguinal 7 femoral 10 postoperative ventral 10 umbilical 3 Since the majority of these were of the inguinal variety there were about thirteen times more recurrences in the males than the females

Most of these hernias had been operated on elsewhere although many had been treated primarily at The New York Hospital The incidence of the entire group of recurrent hernias in relation to all of the hernias encountered in the older age patients was 13 6 per cent The incidence of recurrent inguinal hernias alone was 11 3 per cent In Glenn s series of 1 545 hernias in patients of all ages the incidence of recurrent inguinal hernias seen was 6 1 per cent of all hernias or 8 9 per cent of inguinal hernias Hagan and Rhoads reported 6 9 per cent recurrent inguinal hernias in the relative incidence of groin hernias Grace and Johnson in patients 50 years and older reported a recurrent inguinal hernia incidence of 34 per cent The incidence of recurrence reported from various clinics extends from 7 to 35 per cent The incidence of recurrent inguinal hernia in patients over 60 years of age appears to be somewhat higher than in the younger age group The age at onset of the recurrence (see Table 19 5) is usually under 60 although in this series the patients did not come in for correction until after that age

The recurrence rate relative to age in the series reported by Hagan and Rhoads indicated a rise in rate from the decades 10 to 60 years, with percentages of 2 3 rising to 12 2 After 60 the recurrence rate dropped to 3 7 per cent They too found a much higher incidence of recurrent hernias in males than in females

Diagnosis

The diagnosis is made as for any other hernia Treatment of a recurrent hernia is often made more difficult because of the previous repair In cases of inguinal hernia the exact location of the cord may not be known if the primary repair had been done elsewhere Careful dissection through dense scar tissue is not easy, nor is identification of cord structures simple Because of this there is more apt to be injury to the cord during repair of a recurrent hernia than during a primary repair Once the structures are dissected out the sac is located and repair begun In most instances a direct type of recurrence is encountered (60 40 in The New York Hospital group over 60 years of age) Sometimes however an indirect recurrence is found in which it is obvious that the sac was not dissected high enough and/or not adequately closed at the first repair Recurrent femoral hernias may actually represent hernias overlooked at the time of the first repair

The type of procedure to be employed at the second repair depends in part on the defect found and in part on the tissues with which the surgeon has to work In general however the Cooper s ligament type of repair with further strengthening of the inguinal floor by subcutaneous transplantation of the cord (Halsted I) is preferred for the treatment of recurrent inguinal and femoral hernias

Many cases of recurrent postoperative ventral hernias are the result of wound infection at the time of primary repair poor

repair because of improper approximation of tissue or strangulation of tissue by sutures incorrectly placed At the time of secondary repair, meticulous attention should be paid to the handling of tissues the placement of sutures approximation of tissues and the prevention of fluid collection in the wound with possible secondary infection The same principles hold for the correction of recurrent umbilical hernias

In a series of 75 recurrent inguinal hernias in all age groups Hagan and Rhoads found a 21 per cent rerecurrence rate after secondary repair

The older age group at The New York Hospital revealed a rerecurrence rate of 6 5 per cent while The New York Hospital group including all ages (Glenn) revealed a rerecurrence rate of 14 7 per cent Thus the rerecurrence rate appears to be lower for patients 60 years and older than for the population as a whole

Strangulated (Acute) Hernia

A strangulated or acute hernia is one that has become incarcerated with progressive compression obstruction of the blood supply to the contained structures Signs and symptoms of strangulation vary in intensity but in general consist of abdominal pain usually cramping in character anorexia nausea with or without vomiting a short history of inability to move bowels or pass flatus pain and tenderness over the hernial bulge (this may be a previously reducible or irreducible mass) occasionally redness or discoloration of the skin over the hernia Examination may reveal abdominal distention visible peristalsis borborygmi or (in later stages) a silent abdomen The hernia is irreducible and when one is faced with this type of problem effort should not be made to reduce the mass because reduction en masse of already gangrenous bowel may take place The signs and symptoms are the same regardless of the type of hernia that is strangulated Any patient but especially those in the older age group must have quick but careful evaluation of electrolyte and fluid abnormalities due to the intestinal obstruction secondary to the strangulation Correction of some of these deficiencies must be started prior to surgery in order to minimize the danger of operation However each passing hour increases the danger of gangrene perforation of intestine and generalized peritonitis The patient must be carefully evaluated and operation performed as soon as it is safe to do so Complete correction of existing deficiencies can go on during surgery and in the immediate postoperative period The technique of repair should be dependent on the hernia encountered Here however the minimal amount of surgery should be done Indeed if the patient s condition is extremely precarious reduction and correction of the strangulated bowel (with resection where necessary) without attempt at hernial repair should be done as the emergency procedure Hernia repair can be accomplished at a later date after the patient has recovered from the effect of the episode of strangulation

This method of handling strangulated hernia was used in three cases in The New York Hospital old age group One patient a 73 year old male was explored for signs of intestinal obstruction A strangulated loop of small bowel was found in the ring of a left indirect inguinal hernia The intestine was freed and found to be viable No attempt was made to repair the hernia A second patient a 68 year old female with a 12 year history of ventral hernia was admitted with signs of obstruction Emergency laparotomy was performed and strangulated bowel released Repair of hernia was done several years later The last case encountered is one that vividly illustrates that reducibility of a hernia may not always be indicative of the viability of its contents A 66-year-old male was admitted with a 4 day history of abdominal pain He had a left indirect inguinal hernia that was easily reducible Flat films of the abdomen revealed small bowel obstruction Exploratory laparotomy was performed and small intestine was found strangulated in the hernia The hernia was reduced and repair

was not accomplished until 2 weeks later The fact that the hernia could be reduced preoperatively indicated that this was a reduction en masse

In The New York Hospital group of patients 60 years and older, strangulation occurred in 90 cases, as indicated in Table 19 4 Strangulation is a common cause of intestinal obstruction In the aged, Wantz and Glenn reported 39 instances, 32 5 per cent, of intestinal obstruction due to strangulated hernia, with one death

Recurrence after repair of strangulated hernias was 20 per cent, compared with a recurrence rate of 8 35 per cent for repair of all inguinofemoral hernias

Obviously strangulation is more serious in the patient over 60 years than in the younger patient because of the multiplicity of intercurrent diseases present in this older age group as well as their limited reserve The aged person with a hernia should be advised to have correction before the complication of strangulation occurs Delaying surgery in this age group merely puts it off until they grow even older and often until operation becomes an emergency At such times a patient who at best may have been a fair operative risk is subjected to surgery in the poorest possible condition

TYPE OF ANESTHESIA

The types of anesthesia used in performing hernia repair in The New York Hospital older age group are indicated in Table 19 13 Local was used in 632 local plus general in 69 general in 242 and spinal anesthesia in 15 cases Inguinal and femoral hernias for the greatest part were repaired under local anesthesia while postoperative ventral hernias were most often corrected under general anesthesia The distribution of type of anesthetic used is about the same as that reported by others for the repair of hernias in all age groups The more extensive use of local anesthetics may in part account for the fact that the morbidity and mortality rate in patients over 60 years of age, although higher than in the younger age groups, is not excessive Wherever possible in the very elderly person, local anesthesia is to be preferred not only because of the likelihood of detrimental effects of a general anesthetic on these patients with their multitude of intercurrent diseases, but because more care and gentleness in handling of tissues is required when a local anesthetic is used Thus both mortality and morbidity rates will tend to be reduced

COMPLICATIONS

The complications encountered in The New York Hospital group of patients 60 years and older are listed in Table 19 14 Wound infection occurred in 30 of the 958 repairs Genitourinary tract disturbances such as acute retention epididymitis and cystitis developed in 17 cases Pulmonary complications occurred next most commonly being present in 13 of the cases In 11 in

TABLE 19 13 TYPE OF ANESTHETIC AGENT USED FOR HERNIA REPAIR *

Type of anesthetic	Inguinal			Femoral			Postoperative ventral			Umbilical			Epigastric			Total
	Age yr			Age yr			Age yr			Age yr			Age yr			
	60–69	70–79	80–89	60–69	70–79	80–89	60–69	70–79	80–89	60–69	70–79	80–89	60–69	70–79	80–89	
Local	390	124	0	40	17	1	20	4	1	11	9	0	5	0	0	[illegible]
Local and general	30	18	0	5	2	1	9	3	0	0	0	0	1	0	0	69
General	85	2	2	13	12	0	58	26	1	11	3	0	4	2	0	21
Spinal	10	3	0	1	0	0	0	1	0	0	0	0	0	0	0	13
Total	505	167		59	31		87	34		5	1	0	10		0	958

* The New York Hospital-Cornell Medical Center patients 60 yr and older 193 1958

TABLE 19-14 POSTOPERATIVE COMPLICATIONS FOLLOWING HERNIOPLASTY *

Type of hernia	Age, yr	Wound infection	Urinary tract	Pulmonary			Myocardial		Gastrointestinal		Hematoma	Thrombophlebitis	Reaction to antibiotics	Other †
				Atel	Pneum	Infarct	Failure	Infarct	Ileus	Obstruct				
Inguinal	60–69	10	6	1	2	1	0	0	1	0	2	2	2	3
	70–79	4	3	0	0	0	1	1 ‡	1	0	3	0	0	6
	80–89	0	2	0	1	0	1	0	1	0	0	0	0	0
	Total	14	11	1	3	1	2	1	3	0	5	2		9
Femoral	60–69	0	2	0	1	1	0	0	0	1	0	1	0	3
	70–79	2	2	0	0	0	0	0	0	1	0	0	0	0
	80–89	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	2	4	0	1	1	0	0	0	2	0	1	0	3
Postop. ventral	60–69	4	0	1	3	0	0	0	2	1	4	1	1	1
	70–79	6	2	0	0	0	0	0	0	0	1	0	0	2
	80–89	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	12		1	3	0	0	0		1	5	1	1	3
Umbilical	60–69	1	0	0	1	1	0	0	0	0	1	0	0	0
	70–79	0	0	0	0	0	0	0	0	0	0	0	0	0
	80–89	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	1	0	0	1	1	0	0	0	0	1	0	0	0
Epigastric	60–69	0	0	0	0	0	0	0	0	0	0	0	0	0
	70–79	1	0	0	0	0	0	0	0	0	0	0	0	0
	80–89	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	1	0	0	0	0	0	0	0	0	0	0	0	0
Great total Grand total 104		30	17		8	3	2	1	5	3	11	4	3	1

* The New York Hospital–Cornell Medical Center patients 60 yr and older 193 19 8.

† Specific complications listed in this group acute gallbladder (2) hematemesis postoperative ( ) fracture due to fall (.) temperature elevation postoperative without evidence of wound infection (5) aneurysm inguinal region postoperative (1) keloid (1) maceration skin flap (1) and wound evisceration (1)

‡ Patient died of massive myocardial infarct on sixth postoperative day

stances there was a hematoma of the wound Gastrointestinal difficulties arose in 8 patients 5 of whom had ileus and 3 some degree of mechanical obstruction in 1 of which exploration and lysis of adhesions was necessary The others responded to decompression with an indwelling nasogastric or long tube Four patients developed thrombophlebitis and 3 had reactions to antibiotics one of which was a moderately severe anaphylactic type of response In 2 instances acute cholecystitis necessitating emergency cholecystectomy developed early in the postoperative period Two patients sustained fractures subsequent to a fall 1 or more days after surgery In 5 cases there was a significant temperature elevation for the first 2 to 5 postoperative days The wounds however did not show evidence of infection Although no specific cause for this fever was found the clinical impression in most instances was that it might be the result of slight pulmonary involvement The other miscellaneous complications included hematemesis of short duration in 2 development of an aneurysm in the inguinal region in 1 keloid formation in 1 skin flap maceration in 1 and wound evisceration in 1 Two patients postoperatively developed myocardial failure which was controlled by digitalis In 1 instance on the sixth postoperative day a massive myocardial infarction occurred that led to death There was a total of 104 complications in the entire group of 958 a rate of 10 86 per cent The distribution of complications in the various hernia types is indicated in Table 19 15 In a review of 1 694 inguinal and femoral hernias in patients 19 years of age and older Telle reported a postoperative complication rate of 7 9 per cent The greatest number were pulmonary disease operative site hematoma and wound

TABLE 19 15 NUMBER OF COMPLICATIONS IN VARIOUS HERNIA TYPES *

Age yr	Hernia type				
	Inguinal	Femoral	Postoperative al	Umbilical	Epigastric
60 69	31	9	18	4	0
70-79	18	5	13	0	1
80 89	5	0	0	0	0
Total	54	14	31	4	1
Grand total	101 out of 958 cases = 10 85%				

* The New York Hospital Cornell Medical Center patients 60 yr and older 1932 1958

infection The New York Hospital series of all ages, reported by Glenn had a complication rate of 6 0 per cent Most commonly encountered were pulmonary wound infection and urinary tract complications

Iason, in his series of 175 cases of hernia in patients 60 years and older did not report a rate of complications but stated that urinary retention and hydrocele were the most common ones in operations for inguinal hernia

It is apparent that the incidence of complications in the older age group is higher than that in younger patients The large number of wound infections may be related to a generalized decrease in the ability of the body to combat invading organisms Urinary problems are related largely to the prostatic enlargement that is common in the elderly male Senile emphysema may underlie many of the pulmonary complications in the older patients

Early ambulation adequate fluid intake occasional short periods of deep breathing as well as active leg motion, and frequent change of position while in bed are extremely important in the postoperative management of older persons and will help to decrease complications

Deaths

There were seven deaths in The New York Hospital group of 958 patients 60 years and older, for a mortality rate of 0 73 per cent Five occurred in those with inguinal hernia and two after postoperative ventral hernia repair Four patients were in the 60 to 69 two in the 70 to 79 and one in the 80 to 89 age group There were two deaths from pulmonary emboli, two from bronchopneumonia, and one each from septicemia peritonitis, and coronary occlusion Considering all age groups, Glenn reported six deaths in 1,545 hernias a mortality rate of 0 39 per cent Three deaths were from peritonitis two from pulmonary emboli, and one from coronary occlusion

The mortality rate following surgery for hernia is higher in the older age group than in the general population as might be expected and emphasizes the importance of correcting a hernia as soon after it is detected as possible

CONCLUSION

The problem of hernia in patients 60 years and older differs from that in younger persons primarily because of the intercurrent problems of the aged

The incidence of inguinal and umbilical hernias is about the same in the elderly as in the young Femoral and postoperative ventral hernias, however, occur much more frequently in the older group than in those under 60 years of age Sliding hernias occur more often in the aged group than in the general population

Strangulated hernias of all types constitute an emergency situation and demand immediate correction

The recurrence rate in the aged is not markedly greater than in the younger group It is especially great, however when strangulated hernias are repaired This may be the result of hurried technique because of the patient s poor condition and/or of edema of the structures because of the strangulation In any event the incidence is so high that great care must be taken in performing the repair and indeed if the structures appear edematous, it may be wiser to reduce

the strangulation and correct the hernia at a subsequent procedure

The anatomy of the elderly is like that of the young but there is usually an increase in fatty deposits both pre- and intraperitoneally Musculoaponeurotic and ligamentous structures are apt to be lax The combination of these factors leads to difficulty in repair and increases the possibility of recurrence

Because of the numerous associated conditions (such as hypertension arteriosclerosis pulmonary emphysema and chronic bronchitis) prevalent in patients 60 years and older careful evaluation in regard to choice of anesthesia is important Wherever possible a local anesthetic should be employed since this is apt to disturb the total physiology the least When such conditions as chronic cough constipation and prostatism are encountered these should be corrected before repair is performed in order to allow for strong healing and to decrease the possibility of recurrence

Complications following surgery for hernia are more frequent in the aged than in younger patients and are probably the result of underlying pathologic changes consequent on aging

The mortality rate following hernia repair in patients over 60 years of age although low is about twice as great as the death rate in the general population undergoing comparable surgery

In general hernia in the aged differs from hernia in the young in that the reserve of the older patient is small Preoperative evaluation and preparation choice and administration of anesthesia operative technique and postoperative management must be careful meticulous and skillful The older person s body usually can cope with one challenge to its integrity in adequate fashion Thus the operation can be handled satisfactorily as a rule However if an insult such as infection or cardiovascular pulmonary or urinary tract deficiency is added to an already sagging physiologic structure it may prove to be the straw that breaks the camel s back

BIBLIOGRAPHY

Bassini E Spora 100 casi di cura radicale dell ernia inguinale operata col metoda dell autore Arch Atti Soc ital chir 5 315 1888

Bevan A D Sliding Hernias of the Ascending Colon and Cecum the Descending Colon and Sigmoid and of the Bladder Ann Surg 92 754 1930

Burdick C G Fascial Suture Operation for Hernia Ann Surg 106 333 1937

Burdick C G and Higginbotham N L Division of the Spermatic Cord as an Aid in Operating in Selected Types of Inguinal Hernia Ann Surg 102 863 1935

Burton C C and Blotner C Sliding and Other Large Bowel Herniae Development Classification and Operative Management Ann Surg 116 394 1942

Clear J J Ten Year Statistical Study of Inguinal Hernias A M A Arch Surg 62 70 1951

Dales H C and Kyle J Late Results of Using Tantalum Gauze in the Repair of Large Hernias Surgery 43 294 1958

Erdman S Inguinal Hernia in the Male Late Results in 978 Traced Cases Ann Surg 77 171 1923

Fallis L S Inguinal Hernia Ann Surg 104 403 1936

Gibson C L and Felter R K End Results of Inguinal Hernia Operations Ann Surg 92 744 1930

Glenn F The Surgical Treatment of 1545 Herniae Ann Surg 125 72 1947

Glenn F and McBride A F The Surgical Treatment of 500 Hernias Ann Surg 104 1024 1936

Grace R V and Johnson V S Results of Herniotomy in Patients of More than 50 Years of Age Ann Surg 106 347 1937

Hagan W H and Rhoads J E Inguinal and Femoral Hernias Surg Gynec & Obst. 96 226 1953

Halsted W S Radical Cure of Inguinal Hernia in the Male Bull Johns Hopkins Hosp 4 17 1893

Harkins H N Hernia" in *Surgical Princi*

ples and Practice J B Lippincott Company, Philadelphia 1957

Hotchkiss L W Large Sliding Hernias of the Sigmoid Ann Surg 50 470 1909

Iason A H Incomplete Indirect Inguinal Hernias Arch Surg 41 747 1940

Iason A H Direct Inguinal Hernias Arch Surg 41 857 1940

Iason A H Femoral Hernias Arch Surg 41 1229 1940

Iason A H Ventral Hernias South Surg 9 617 1940

Iason A H Inguinal and Femoral Herniorrhaphy Surg Gynec & Obst 88 473 1949

Iason A H Hernia in Aged Persons J Am Geriatrics Soc 4 242 1956

Koontz A and Graves J W Preoperative Pneumoperitoneum as an Aid in the Handling of Gigantic Hernias Ann Surg 140 759 1954

Longacre A B Follow up of Hernia Repair Surg Gynec & Obst 68 238 1939

Maier R L The Present Status of the Injection Treatment of Hernia Ann Surg 122 85 1945

Maier R L The Use and Abuse of Inert Materials in Hernia Repair (editorial) Am J Surg 94 1 1957

McVay C B Hernia in *Christopher s Text book of Surgery* 6th ed W B Saunders Company Philadelphia 1956

McVay C B and Anson B J A Fundamental Error in Current Methods of Inguinal Herniorrhaphy Surg Gynec & Obst 74 746 1942

Moschcowitz A V The Rational Treatment of Sliding Hernia Ann Surg 81 330 1925

Parsons W B Silk Sutures in the Repair of Hernia Ann Surg 106 343 1957

Ryan E A An Analysis of 313 Consecutive Cases of Indirect Sliding Inguinal Hernias Surg Gynec & Obst 102 45 1956

Sensenig D M and Nichols J B Sliding Hernias a Follow up Study A M A Arch Surg 71 756 1955

Shelley H J Complete Indirect Hernias South Surg 9 257 1940

Simmons C C The End results in 70 Consecutive Cases of Umbilical Hernia Operated on at the Massachusetts General Hospital Boston M & S J 174 342 1916

Telle L D Inguinal and Femoral Hernia A Review of 1694 Cases Am J Surg 93 433 1957

Wantz G E and Glenn F The Treatment of Intestinal Obstruction in the Aged J Am Geriatric Soc 3 974 1955

Zimmerman L M A Critique of the McVay Operation for Inguinal Hernia Surg Gynec & Obst 87 621 1948

Zimmerman L M and Anson B J *Anatomy and Surgery of Hernia* The Williams & Wilkins Company Baltimore 1953 p 127

Zimmerman L M and Laufman H Sliding Hernia Surg Gynec & Obst 75 76 1942

Part 5

Surgery of the Biliary Tract and Liver

20

Gallbladder and Biliary Tract

Frank Glenn and Bjorn Thorbjarnarson

Biliary tract surgery has steadily advanced since Bobbs performed the first cholecystostomy in 1867 and Langenbuch removed the first gallbladder in 1880 Prior to this time the treatment of biliary tract disease was the domain of the internist and the only time a surgeon would remove gallstones was when a spontaneous fistula formed to the exterior and probing revealed the calculi

After surgery was introduced it soon became evident that the morbidity and mortality associated with the operation came from the advanced cases which presented complications Even 60 years ago Kehr one of the pioneers of biliary tract surgery stated that the mortality from cholecystectomy was less than 3 per cent as long as the stones were confined to the gallbladder and demonstrated the progressive risk from surgery as complicating factors were added

The concept of cholecystectomy as a measure to prevent the complications of cholelithiasis has slowly gained acceptance and it is likely in the future to eliminate somewhat the problems of biliary tract surgery in the aged

There is evidence to indicate that calculous disease of the biliary tract has its beginnings early in life in particular among women where pregnancy plays an overwhelming etiologic role Men are much less frequently afflicted and the ratio of women to men is somewhere between 3 1 and 4 1

Over the years the total number of patients undergoing surgery for biliary tract disease has increased mortality has decreased and the average age at operation as well as at death from surgery and its complications has increased

In The New York Hospital and elsewhere an increase in the absolute number of persons 65 and over undergoing biliary tract surgery has been observed as might be expected from the greater longevity of the population During the period from 1932 to 1954 a total of 360 patients 65 years old and over underwent operation for biliary tract disease (nonmalignant) or an average of 16 patients each year During the period from 1954 to 1957 145 surgical pavilion patients in the same age category have been operated upon an average of around fifty each year

Gallstone disease which constitutes over 90 per cent of biliary tract disease is a progressive ailment which in its course slowly causes local complications and effects insidious changes in distant vital organs Once stones are formed it is rare for them to disappear rather they tend to increase in size and number After the age of 50 the incidence of common duct stones seems to increase perceptibly decade by decade

In the future the results of early cholecystectomy for stones in the young population may become apparent in lessened incidence in the older age groups Until that time we may expect to see increasing numbers of elderly persons with complicated biliary tract disease and the concomitant degener-

ative processes of old age affecting vital organs This chapter includes the authors' experience in handling this group of patients and the concepts they believe necessary for optimal results of therapy

PREOPERATIVE EVALUATION

Preoperative evaluation is initiated by obtaining a complete history and making a physical examination Laboratory data is of great value when it provides significant information Routine examinations should be few, specific procedures being indicated by the history and physical examination Usually these include a complete blood count urinalysis blood urea determination a chest x ray film and an electrocardiogram Other information from the laboratory may be indicated for example in the dehydrated and acidotic patient If it may be helpful it should be obtained The amount of time that is spent in evaluation of the patient is a matter of clinical judgment Urgency in itself is a reason for caution on the other hand evaluation decision and preparation are essential to efficient therapy When immediate surgical intervention is indicated time should not be squandered

The presenting symptoms of biliary tract disease in the older age group parallel those encountered in the younger The onset may be sudden or it may be gradual The great difference rests in the duration of the underlying pathologic process In women biliary calculi may appear during the childbearing period These may cause few or no immediate symptoms and at the same time result in changes within the biliary tract Equally important in the elderly are possible systemic degenerative changes that may determine the capacity of the patient to withstand the burden of a surgical procedure Actually one may predict where the greatest risk for a patient rests by carefully evaluating the biliary tract disease and the status of the various systems This the authors have done in 505 patients observed over a 25 year period

Diagnostic Classification

Of these geriatric patients 344 were treated for chronic cholecystitis 146 for acute cholecystitis and 15 for postoperative and other benign strictures of the choledochus The percentage of patients with acute cholecystitis as opposed to chronic biliary tract disease in the total series was 18 7 per cent among those under 50 years of age 21 9 per cent among those 50 to 64 years of age and 28 9 per cent among those 65 years of age and older

Degenerative Disease Processes

The presenting symptoms of biliary tract disease in the older age group varied little from the others The more advanced changes in the biliary tract, resulting from long standing disease such as common duct stone and biliary cirrhosis were of course more frequent The differences observed in the older age group in comparison with the younger patients included the systemic degenerative changes, all of which have a bearing on the outcome of any surgical therapy

For the purpose of attempting to predict postoperative fatalities and complications the 505 operative patients were classified according to the major degenerative disease processes discernible in the preoperative state (Table 20 1) The mortality for the entire group was 6 3 per cent (32 postoperative deaths)

One hundred sixty one (not the largest group) were regarded as having no major degenerative disease process These patients did have some but not a major degree of generalized arteriosclerosis osteoarthritis diverticulosis or benign prostatic hypertrophy There were 23 nonfatal complications (14 3 per cent) and 4 fatalities (2 5 per cent) among the aged patients in this group without recognized major disease processes

Hypertensive cardiovascular disease was present in 189 patients (the largest group) These were patients with a sustained systolic blood pressure over 160 or a diastolic blood

TABLE 20-1 PREOPERATIVE EVALUATION OF 505 PATIENTS 65 YEARS OF AGE AND OLDER IN RESPECT TO THE PRESENCE OF DEGENERATIVE DISEASE PROCESSES

	No of patients *	*Nonfatal complications*	*Mortality*
No major degenerative disease	161	23 (14 3%)	4 (2 5%)
Hypertensive cardiovascular disease	189	31 (16 4%)	15 (7 9%)
Arteriosclerotic heart disease	116	20 (17 2%)	10 (8 6%)
Diabetes mellitus (moderate to severe)	30	4 (13 3%)	
Chronic pulmonary disease	44	5 (11 4%)	3 (6 8%)
Cirrhosis	9	1 (11 1%)	2 (22 2%)
Chronic renal disease	9	1 (11 1%)	2 (22 2%)
Miscellaneous major chronic disease	52	7 (13 5%)	3 (5 8%)

* Eighty-one patients are classified in two groups 7 in three groups 2 in four groups and 1 in five groups

pressure over 90 They had enlarged hearts with left ventricular preponderance determined by electrocardiogram The highest consistent pressure was 230/120 There were no cases of malignant hypertension There were 31 nonfatal complications (16 4 per cent) and 15 deaths (7 9 per cent) following surgery in this group

Arteriosclerotic heart disease of a significant degree was noted in 116 patients These individuals had sustained previous coronary occlusion (by electrocardiographic study) or had demonstrated electrocardiographic changes of a less marked degree associated with angina pectoris or cardiac decompensation There were 20 nonfatal complications (17 2 per cent) and 10 deaths (8 6 per cent) in this group following surgical intervention for biliary tract disease

Severe chronic primary pulmonary disease consisting of severe emphysema and bronchiectasis was present in 44 cases There were five nonfatal complications (11 4 per cent) and three fatalities following surgery among these patients

Diabetes mellitus of a degree requiring significant daily insulin administration was present in 30 cases There were four nonfatal complications (13 3 per cent) and no post operative deaths in this group

Cirrhosis complicated by hemorrhage from esophageal varices ascites or jaundice was present in nine instances (by pre operative evaluation) There were two post operative deaths in this group (22 2 per cent) following biliary tract surgery

The most striking conclusion to be drawn from an analysis of these patients is that an elective biliary tract procedure is tolerated remarkably well by the geriatric patient in fact the difference in the complication rate and mortality rate between the aged (over 65 years) and the control (50 to 65 years) group is not great In contrast the aged patient tolerates relatively poorly emergency biliary tract procedures either for simple acute cholecystitis or for acute cholecystitis with choledocholithiasis Both mortality and complication rates are strikingly higher than in patients in younger age groups This observation supports the concept that elective cholecystectomy in the aged patient with symptomatic biliary tract disease is even more important than in the younger patient who can better tolerate the emergency procedure if such becomes necessary The aged patient even with advanced degenerative disease processes when carefully evaluated and prepared for surgery may be operated upon with a mortality of less than 2 per cent In acute cases the improvements in all types of pre operative and postoperative care of patients with biliary tract disease have produced notable reductions in mortality and complication rates in the younger age groups but

in the aged the mortality for such procedures remains above 5 per cent

These data place proper emphasis upon the degenerative disease processes in the older age group because they are directly associated with many of the postoperative complications and deaths Many of these can be prevented by use of proper measures based upon an understanding of the pathologic physiology and by not overtaxing the patient s capacity

PREOPERATIVE PREPARATION

The preoperative preparation of the geriatric patient for surgery upon the biliary tract is determined to some degree by the urgency of the condition When immediate surgical intervention is indicated the preparation must be rapid and yet as thorough as is practicable for it is in this group that the operative mortality is the highest When the condition is chronic time becomes less important and preoperative preparation can be deliberate and leisurely Circumstances provide a wide zone between the urgent and emergent category and those in whom surgical treatment may be termed elective For this reason the authors approach is directed largely at the systems other than the biliary ductal system These will be discussed under the headings of circulation cardiovascular system pulmonary disease renal function, nutritional problems impairment of liver function and diabetes

Circulation

The circulating blood volume is frequently below normal values in the elderly patient If it is further depleted by an acute process or an operation that decreases the fluid intake and increases the fluid loss a severe and even irreversible hypotension may result The more arteriosclerotic the vascular system the more fixed it is and the less able to compensate for acute blood loss that might occur at operation Furthermore relatively mild anoxia occurring in the presence of a reduced red blood cell mass may result in severe damage to vital tissues, such as the brain and the heart Red blood cell counts hematocrits, or serum protein determinations that are within the normal range do not exclude a reduced blood volume For these reasons whenever possible the authors perform preoperative blood volume determinations These provide a base line that enables immediate correction of deficiencies before surgery The older and more depleted the patient, the greater is the importance of this preliminary step

CASE REPORT No 1 A (N Y H No 605770)

Chronic cholecystitis and cholelithiasis anemia Sex male age 78

Present illness The patient s history revealed that for many years he had had fatty food intolerance and attacks of epigastric and right upper quadrant pain In the previous 6 months the patient had lost 25 lb of weight

Past history Typhoid fever as a young adult

Physical examination Temperature 36 5 C pulse 68 blood pressure 160/90 respirations 18 per minute The patient was a well developed white male with signs of recent weight loss Positive findings were limited to the above

Laboratory examination Hemoglobin 7 5 hematocrit 30 white blood cell count normal stools negative for blood on first three examinations but later specimens were obtained with a trace to 4+ on guaiac examination

Repeated attempts to visualize the gall bladder by oral cholecystography were unsuccessful Radiologic examination of the upper gastrointestinal tract revealed a deformed duodenal bulb Examinations of the large bowel were normal

Preoperative diagnosis was (1) cholelithiasis (2) duodenal ulcer

Course The patient s anemia was investigated and judged to be due to blood loss from the gastrointestinal tract probably from a duodenal ulcer The blood volume deficit was corrected by three transfusions of 500 cc of whole blood each The bleeding stopped while in the hospital Two weeks following admission an abdominal exploration was carried out An active duodenal ulcer with minimal scarring was found as was chronic chole

cystitis with cholelithiasis A cholecystectomy was done and the patient was discharged on a dietary regimen aimed at his duodenal ulcer

Deficiencies are suggested by clinical observation Dehydration and salt lack should be suspected if tissue turgor and dryness of the tongue are noted The more exact determinations and the ones to be followed in the correction of deficiencies require appropriate laboratory studies Accurate records of intake and output are essential and should be instituted when the patient first comes under observation Insensible and abnormal water losses are best determined by repeated weighing of the patient

Impaired kidney function is frequent in the aged and often results in excess sodium loss Electrolyte determinations should be made frequently enough to be certain that the status of the patient is secure Parenteral fluid and electrolyte replacement and administration must be performed with care in the aged because myocardial reserve is often low and congestive heart failure may result When it is recognized that cardiac function is marginal it is well to tend toward dehydration rather than overhydration In this regard Ziffren and Sheets and others have cautioned against the too rapid overcorrection of salt loss They have observed cases of cardiac failure with peripheral edema in which the patient was actually *dehydrated* Such individuals should be given 5 per cent glucose in water because of the high electrolyte content of the edema fluid

Cardiovascular System

Elderly individuals characteristically have reduced cardiac reserve and loss of pliability of their blood vessels While this statement is generally true there is such a wide variation among individuals of comparable age that it is important always to evaluate each patient Perhaps the best index is the amount of physical activity the patient has been indulging in during the preceding year in relation to previous years If this has apparently been reduced or seems limited certain relatively simple tests will provide valuable information Venous pressure determination and measurement of the circulation time may indicate not only a lack of reserve but frank failure Coller and Dobbie have stated that following the injection of a single dose of a mercurial diuretic one patient lost over 5 lb of edema fluid that had not been obvious Elective surgery should not be embarked upon in patients with congestive heart failure Neither should they be rapidly digitalized and operated upon rather a few weeks should be used for their stabilization If surgical intervention is urgent rapid digitalization can be accomplished with Cedilanid with use of an initial dose of 0 8 mg followed by 0 2 mg every 3 hours until a full therapeutic effect has been established Whenever diuretics are employed in congestive heart failure abnormal electrolyte losses should be sought and corrected

Case Report No 1 B (N Y H No 648506)

Chronic biliary tract disease in a patient with myocardial failure auricular fibrillation and diabetes on the basis of arteriosclerosis Sex female age 72

Present illness Two days prior to admission the patient noted the onset of severe right epigastric pain following a spaghetti dinner The pain had continued intermittently and was associated with nausea and vomiting Vomiting was repeated and the patient was unable to retain food

Past history At the age of 21 the patient had jaundice of unknown etiology She had had intolerance of fatty foods for years Recently the appetite had been poor and she had noted a weight loss of 15 lb She had had known diabetes for 10 years and had taken digitalis sporadically for 5 years

Physical examination Temperature 37 7 C pulse 80 blood pressure 130/60 respirations 18 per minute The patient was an elderly slightly obese female looking chronically ill Eyes scleras not jaundiced Fundi arteries tortuous punctate hemorrhages similar to diabetic retinopathy Neck veins not distended Chest lungs clear Heart irregular rhythm A louder than P Blowing soft apical systolic

murmur Abdomen soft not distended Liver edge palpable 4 *fingerbreadths below* the costal margin Tenderness without guarding or rebound in right upper quadrant *Gallbladder not palpable*

Laboratory examination Urinalysis revealed sugar and acetone Blood sugar was 254 mg per 100 cc White blood cell count was 15 500 per cu mm There was some slight shift to younger forms among the granulocytes

Roentgenographic examination of the chest and abdomen showed a calcification in the region of the gallbladder and cardiac enlargement

Electrocardiogram revealed auricular fibrillation and ventricular premature contraction associated with coronary artery *disease*

The diagnosis on admission was (1) chronic cholecystitis and cholelithiasis *with a subacute exacerbation* (2) diabetes mellitus with diabetic arteriosclerosis (3) arteriosclerotic heart disease with auricular fibrillation borderline compensation

Course After admission the patient was given nothing by mouth An infusion of dextrose and water covered with insulin was started and urine specimens were followed for sugar and acetone On the second day after admission moist rales were discovered over the bases of both lungs and digitalization was carried out over the next 24 hours Vomiting had then stopped and the patient was given fluids by mouth Intravenous cholangiogram performed the day after admission showed a normal common duct and a gallbladder filled with stones The patient continued to improve in the hospital although recurrence of the pain was noted on two occasions Seven days after admission the patient was considered in optimal condition and a cholecystectomy was carried out under general anesthesia The gallbladder contained numerous stones but the common duct appeared normal and was not explored The *nasogastric suction* tube was removed after 24 hours The patient was out of bed on the first postoperative day and was discharged after an uncomplicated postoperative course 9 days following operation

Two weeks following discharge the patient was readmitted with hemiparesis and she died 3 weeks later

Autopsy findings

1 *Arteriosclerotic* cardiovascular disease with old myocardial infarction

2 Cerebral arteriosclerosis

3 Thromboembolism cerebral with ischemic infarction

4 Arterial and arteriolar nephrosclerosis

5 Pulmonary atelectasis and fibrosis

6 Diabetes mellitus (moderate degree of hyalinization of most of the islands of Langerhans

Cardiac arrhythmias may be difficult for the surgeon to evaluate They may be of little significance, but on the other hand they may be the result of a serious cardiac lesion In either event they merit investigation and an expert opinion The underlying cause is as important as the arrhythmia *Auricular fibrillation with a rapid rate* responds well to digitalis Paroxysmal auricular and nodal tachycardia are often indications for quinidine therapy as is auricular flutter In the aged myocardial changes are *usually pronounced in the* presence of such manifestations and the quinidine should b used with caution It is probably contraindicated in chronic long standing auricular fibrillation and in heart block Ventricular tachycardia is *best treated with Pronestyl* rather than digitalis The danger in changing an arrhythmia of some duration is that emboli may be liberated into the systemic circulation

Coronary heart disease is *frequently* present in elderly patients and it is probable that its incidence is somewhat higher in those with biliary tract disease The authors have estimated this to be 15 to 20 per cent Othe s have observed *that it is more* frequently encountered in this group of patients than in comparable age groups without biliary tract disease Acute coronary occlusion and/or myocardial ischemia lurks in these *patients and may be precipitated* by further reduction of a subnormal blood volume and anoxia or hypotension during anesthesia or operation The much used electrocardiogram may give information suggestive of coronary *heart disease* but it may also be negative There is a tendency for a normal electrocardiogram to be accepted as strong evidence that coronary *heart disease* is not

present this is erroneous The surgeon should ever be aware of this and consider that such hidden disease is a frequent basis for one of the many complications that may occur in the treatment of the geriatric patient

Case Report No 2 (N Y H No 458832)

Patient with recognized coronary artery disease Death from acute coronary occlusion postoperatively Sex male age 73

Present illness The patient had complained of epigastric pain of varying intensity for 3 months He had nausea and vomiting and for the 3 days preceding admission the pain had been constant During this period the patient was completely unable to retain any food or fluids

Past history Suprapubic prostatectomy 4 years previous Six months previous the patient had a stroke from which he recovered except for some difficulty swallowing He had been taking digitoxin and Mercuhydrin for many years because of hypertensive cardiovascular disease

Physical examination Temperature 38 8 C pulse 88 irregular blood pressure 170/100 respirations 24 per minute The patient was a poorly nourished well developed white male acutely ill

Chest Lungs diminished breath sounds bilaterally Heart no murmurs A louder than P

Abdomen Marked right upper quadrant tenderness and guarding Liver extended 4 fingerbreadths below the costal margin

Laboratory examination Urinalysis 2+ albumin Hemoglobin 16 Gm per 100 cc White blood cell count 22 700 per cu mm Differential count 77 mature granulocytes 15 band forms 2 lymphocytes 5 monocytes 1 eosinophil Venous pressure 180 mm of saline

Electrocardiogram Many auricular premature contractions Anterior apex myocardial infarction probably old

The diagnosis on admission was (1) acute cholecystitis with possible perforation (2) dehydration (3) arteriosclerotic heart disease with hypertension and early heart failure

Course The patient was slowly hydrated Medical consultation was obtained and the severe nature of the patient s heart disease recognized As moist rales were occasionally heard at the bases and because of the elevated venous pressure digitalis effect was improved by adding 0 2 mg ouabain Mercuhydrin 2 cc was also given The patient s abdominal signs progressed over the next few hours and impending perforation was suspected Accordingly a cholecystostomy was performed under general anesthesia Acute cholecystitis and cholelithiasis was found at operation The patient was in poor condition immediately following the operation but improved and was doing quite well when he suddenly went into shock on the fourth postoperative day and died

Autopsy findings

1 Recent myocardial infarction hypertensive and arteriosclerotic cardiovascular disease

2 Arteriosclerosis of the cerebral arteries with multiple infarcts of the brain

The surgeon is often called in consultation to evaluate biliary tract disease that has been brought to attention by some other illness For example a patient may have had a coronary occlusion As he improves he undergoes a complete examination and gall stones are found The history reveals that he has had recurrent attacks for years He had thought that his coronary occlusion was a variation in his attacks of indigestion Both physician and patient are eager to have this corrected but the question of when this should be done in relation to the coronary occlusion arises The authors have arbitrarily set the interval at 3 months Their experience has been encouraging First these patients have for the most part withstood the operative procedure well going through the postoperative period without complications Second relief from attacks of indigestion not only has made life more comfortable but also has freed these individuals from the apprehension that comes from the constant fear of an impending heart attack so closely simulated by a gallbladder attack

Case Report No 3 (N Y H No 443077)

Angina pectoris improved by cholecystectomy Sex female age 65

Present illness Ten years prior to admission the patient had noted the onset of frequent attacks of fairly typical anginal pain Five years previously she was hospitalized in another hospital with the diagnosis of myocardial infarction The anginal type of pain was brought on by exertion Four years ago the patient had the onset of postprandial attacks of right upper quadrant pain with indigestion and flatulence Along with the right upper quadrant pain she would experience the anginal type of pain which was substernal and radiated down the left arm but which was relieved by taking nitroglycerin Oral cholecystography demonstrated the patient to have gallstones and she was admitted for cholecystectomy

Physical examination Temperature 37 6 C pulse 80 blood pressure 115/60 respirations 20 per minute The patient was a well developed obese white female not acutely ill There was moderate epigastric tenderness Examination of the heart and lungs was normal

Laboratory examination Electrocardiogram normal Chest roentgenogram borderline cardiac enlargement

The diagnosis on admission was (1) chronic cholecystitis and cholelithiasis (2) coronary artery disease with angina

Course One week following admission a cholecystectomy was carried out under general anesthesia Particular attention was paid to ensuring good oxygenation during operation On the first postoperative day the patient had one attack of precordial pain radiating into the left arm This attack promptly subsided and her recovery was excellent She was discharged 7 days after surgery The patient has been followed in the medical and surgical clinics since discharge For 2 years there was a marked improvement in her angina The pains were very infrequent and mild The electrocardiogram remained normal At this time the patient began to gain weight and to have attacks of paroxysmal nocturnal dyspnea She was given diuretics and placed on a reducing diet At the present time the patient is relatively free from anginal pain 5 years after surgery

Pulmonary Disease

Pulmonary emphysema and chronic pulmonary fibrosis are present to some extent in most patients over 65 and among men in particular These conditions are associated with a decrease in pulmonary function but may cause no symptoms because the activity of this older age group is not so great as that of the younger The reduced respiratory reserve may therefore come to light unexpectedly when increased demands are placed upon it or when function is further diminished by infection or right heart failure Every effort should be made to prevent postoperative pulmonary complications such as tracheitis atelectasis and pneumonia because they are much more serious in the older age group when they do occur Owing chiefly to the improvement in anesthesia over the past 20 years postoperative pulmonary complications have been greatly reduced Good anesthesia followed by early mobilization does much to obviate the hazards of atelectasis and pulmonary infection Oral sepsis bronchiectasis chronic sinus disease and chronic pulmonary infection of any kind are some of the contributors to this danger Recognition and proper preoperative management of them plus the appropriate prophylactic chemotherapy when operation is performed should further decrease the incidence of pulmonary complications

One of the most difficult problems in preoperative preparation is encountered in the patient with asthma who has marked pulmonary changes These individuals are difficult enough to handle under normal circumstances when an episode of asthma occurs during the postoperative period it may be fatal The elderly asthmatic patient requires constant attention He must be protected from whatever allergens initiate his attacks and from other things that may be irritating to the respiratory tract Flowers tobacco smoke feather pillows for example are but a few of the items that may set off an uncontrollable chain of events If such patients have an excess of water in their tissues because of nutritional disturbance impaired renal function or cardiac failure the burden is greater Diuretics may be indicated Vaponefrin and aminophylline administered orally or rectally help control

bronchospasm Cortisone has been successfully used in preparing these patients 100 mg three times a day is given for 2 to 5 days and then gradually reduced to 50 mg once a day Because cortisone depresses the normal adrenal response the original dosage of 300 mg is given on the day of operation and gradually reduced over 8 to 10 days thereafter In prolonged acute episodes an infusion of 15 to 30 mg of ACTH in 500 cc of 5 per cent glucose in distilled water given over a 6- to 8 hour period has been favorably reported by Fromer These patients are among the most distressing that the authors have observed They present complex problems and should be evaluated with deliberation and prepared and observed longer than most patients Operation should not be attempted if response to therapy is poor

Renal Function

Disturbances of renal function in the aged closely parallel those of the vascular system These changes are most marked in the tubules as compared with the glomeruli Thus the ability to concentrate urine and conserve body base is impaired This can readily be evaluated by urine examination and by concentration tests When such dysfunction is present some improvement can be obtained by rest with avoidance of fatigue regulation of daily nutritional intake to limit protein to 0 5 Gm per kg of body weight limitation of sodium chloride to 3 Gm per day and fluid intake to 2 500 to 3 000 cc per day if the urinary output remains adequate Sodium potassium and chloride blood levels should be determined daily and provision made to correct an abnormal trend both immediately and when operation is embarked upon Reduced red blood cell mass and low blood volume should be corrected by administration of whole blood or washed red blood cells as indicated Renal function should always be evaluated in conjunction with the status of the liver Liver function is difficult to measure directly but indirect evidence of liver damage such as cirrhosis with a reversal of the albumin/globulin ratio an elevated alkaline phosphatase and prolonged jaundice should arouse suspicion of such dual problems

Infection within the urinary tract if present concurrently with impaired renal function should have the benefit of indicated therapy In the elderly male prostatic hypertrophy with obstruction and infection is by no means infrequent When surgery on the biliary tract is elective and when it is the opinion of the urologist that surgical correction is indicated it has been the authors practice to have the urinary obstruction and infection treated first When confronted with this situation in a patient with acute cholecystitis or an obstructive jaundice that urgently requires surgery the authors are inclined to do the least procedure that will relieve the biliary tract problem and postpone indicated definitive treatment until the urologic problem has been dealt with satisfactorily In elderly women with urinary infection the problem is seldom as serious even when there is urinary retention due to perineal prolapse Chemotherapy and bladder decompression by a retention catheter may permit the more rapid preparation of the patient for biliary tract surgery

Case Report No 4 (N Y H No 05110)

Chronic cholecystitis and cholelithiasis benign prostatic hypertrophy bladder calculus Sex male age 67

Present illness The patient had had attacks of indigestion and right upper quadrant pain for over 7 years Two years previously the patient was considered for a cholecystectomy because of the finding of a nonvisualized gallbladder on oral cholecystography At this time however he was found to have severe urinary retention and impaired renal function A prostatectomy was carried out and the patient was followed The symptoms of urinary tract obstruction and infection did not adequately subside and a year later he was found to have a bladder calculus which was removed Following this operation the urinary symptoms promptly subsided and renal function improved He was then considered ready for cholecystectomy

Physical examination Temperature

37 2 C pulse 82 blood pressure 140/80 The patient was a well developed well nourished white male not acutely ill There was no abdominal tenderness nor were any masses palpable

Laboratory examination Urinalysis oc casional red and white cells

Course At the time of admission the patient had no urinary symptoms Three days later a cholecystectomy was carried out under general anesthesia Chronic chol ecystitis and cholelithiasis was *found* The patient had one episode of urinary tract *in* fection postoperatively but this promptly subsided on antimicrobial therapy he was discharged 7 days following the operation The symptoms due to gallbladder disease were relieved

Nutritional Problems

The extremes of the nutritional state are to be observed in the elderly patients with gallbladder disease In some there exists a disturbance of cholesterol metabolism Obes ity especially among women may reach grotesque proportions Diet restrictions are often difficult for these patients to accept Hospitalization may be required if this haz ard to surgery is to be overcome but the authors have observed that even this some- times fails Metabolic studies and endocrine therapy have on occasion been beneficial in effecting the desired objective in the more difficult problem cases

Malnutrition and underweight are also seen in the aged In most patients this is attributable to the symptoms of biliary tract disease that are precipitated by eating In others it may be related to dental caries a lack of teeth or ill fitting dentures Occa sionally it has been observed as the result of an associated peptic ulcer or anacidity Men tal depression and limited physical activity often cause underweight among those who live in old peoples homes Regardless of the cause or causes the malnutrition should be corrected so far as it is possible to do so before operation For many a change of environment with special effort directed towards making the food attractive as well as providing the required caloric intake will correct the situation, while in others special measures may be needed Sustagen supple ments or comparable preparations when protein is lacking may be effectual In severe anorexia tube feeding may be required Tes tosterone, 25 mg dosage 3 times a week has been used with benefit for improving protein metabolism As a general rule the under nourished patient can have his deficiencies corrected adequately within a reasonable pe riod so that operation can be *done* Th nutritional status where gallbladder disease has been the cause is markedly improved by the cholecystectomy

Impairment of Liver Function

Damage to the liver from long standing biliary tract disease is a problem of real magnitude and is of course, the central tar get of the attempts to prevent as well as to interrupt biliary tract disease at any age We are inadequately informed on this subject In general it may be said that the longer gallstones have been present and the more infection has accompanied them the greater is the damage to the liver The liver is known to have remarkable powers of withstanding injury Many patients live to the extreme of old age with biliary calculi having appar ently normal lives and dying of some unre lated condition The direct opposite is to be seen in the elderly patient who gives no his tory of biliary tract disease until he develops jaundice due to a calculus in the common duct At operation a biliary cirrhosis of the liver is found The burden of the operation including the hepatotoxic effects of trauma tized tissue and drugs precipitates an irre versible liver failure Nor can we ascribe the condition of the liver of the elderly entirely to the lowly gallstone It may have been injured by infections ranging from the colon bacillus to amoeba by toxic agents from alcohol to carbon tetrachloride as well as by deficient diets and blood dyscrasias When surgery upon the biliary tract is required it is not the causative factor that is so impor tant but rather how much damage has been done and what measures may be employed to correct it Furthermore it is incumbent upon the surgeon to recognize the conditions that exist if not before operation then when

the abdomen has been opened and before removing the gallbladder or exploring the common duct He should know that an unexpected congested liver due to right heart failure may be the cause of right upper quadrant symptoms and sometimes of the failure of the gallbladder to be visualized by cholecystography that the tender area attributed to a *distended gallbladder* was *in fact* the margin of the congested and enlarged liver The acalculous gallbladder should not be removed and furthermore to do so may be a fatal error To further illustrate distressing situations that may be encountered a portal cirrhosis with a portal hypertension may be found without intrinsic biliary tract disease While it is true that these are primarily mistakes in diagnosis and that they are relatively infrequent it is not amiss to emphasize that if the surgeon is not critical of his findings at operation he may compound one error into a fatal outcome needlessly and without justification The list of tests that have been evolved as aids in estimating impaired liver function is long and they are well described in textbooks on the subject Estimates of their values differ widely among different clinic groups Suffice it to say that those who undertake the surgical treatment of biliary tract disease either in the elderly or in any age group should utilize a few laboratory methods that they have found dependable and practicable in the light of available facilities

In the authors practice they have followed a policy of repeating and doing serial studies on all patients whose tests have revealed impaired liver function The extent of liver damage indicates to some extent how much time one may anticipate will be required to correct it Where for example a prothrombin deficiency is found in an obstructive jaundice the administration of vitamin K may be expected to correct the bleeding tendency almost immediately and if it does operation need not long be postponed If however the response is poor then the extent of liver damage is likely to be great and may even be a contraindication to operation

Impaired liver function is often improved by certain general measures such as a high caloric diet rich in protein and carbohydrate and low in fat supplemented by the essential vitamins Limited activity to avoid fatigue the elimination of infection related or unrelated to the biliary tract and restriction of possible toxic drugs and alcohol are measures that may be beneficial The *improvement of impaired liver function in the aged* is often a slow and tedious process If it cannot be successfully accomplished surgery may have to be abandoned One must balance the risk of the anticipated course of the disease process with the added risk that surgery imposes This latter should never be underestimated in the patient with impaired liver function regardless of the underlying cause The more heroic the procedures that are required to improve liver function and its related conditions the narrower will be the margin against which the surgeon must work if operation is embarked upon Hypoproteinemia and low serum albumin levels may be corrected by blood transfusions and concentrated serum albumin without changing very much the capacity of the liver to function any better when its burden is increased

CASE REPORT No 5 (N Y H No 109530)

Chronic cholecystitis and cholelithiasis severe cirrhosis of the liver Sex female age 73

Present illness For many years this patient had had right upper quadrant pain and flatulence with intolerance for fatty foods Three years previously she was found to have cirrhosis of the liver and cholelithiasis She had been treated on both an inpatient and an outpatient basis with a high protein low salt diet with supplement of vitamins She was known to have esophageal varices The etiology of her cirrhosis was unknown but it was felt to be probably related to her cholelithiasis as no other cause was apparent She was admitted for cholecystectomy

Physical examination Temperature 37 C pulse 60 blood pressure 160/80 Abdomen liver edge palpable 4 finger breadths below the costal margin

Laboratory examination Esophago-

gram esophageal varices Hematocrit 40 Alkaline phosphatase 40 units Total bili rubin 3 7 mg direct 2 1 mg indirect 1 6 mg Cephalin flocculation 13 units Total cholesterol 204 mg esters 59 1 per cent Prothrombin time 14 8 seconds (normal) Total proteins 6 8 Gm Albumin/globulin ratio 3 5 3 3

Intravenous cholangiogram showed dila tion of the hepatic duct and cholelithiasis in the gallbladder

The admission diagnosis was (1) cir rhosis of the liver (2) cholelithiasis prob ably choledocholithiasis

Course The patient was explored 1 week after admission The gallbladder was found to contain stones A stone in the cystic duct was found to obstruct partially the common duct There was marked por tal hypertension 40 cm of water The gall bladder was removed and the common duct explored and decompressed Care was taken not to disturb the collateral circulation The postoperative course was relatively uneventful There was no evi dence of bleeding or ascites formation

An incidental finding was a microscopic focus of carcinoma in the gallbladder wall

The patient was discharged 3 weeks after her operation

Diabetes

Diabetes in the aged is almost invariably the result of arteriosclerosis and is not se- vere *It can be readily controlled by diet and* relatively small doses of insulin An evalua- tion of each patient in this regard and provi sion to control the disease before operation will do much to prevent an acute diabetic acidosis This of course is not feasible in the person who is admitted to the hospital with acute cholecystitis and who has been ill sometimes for several days with vomiting and an elevation of temperature Under these circumstances immediate measures to con trol the diabetes are in order so that the operation may not be delayed The most dependable guide to follow is the hourly determination of the ketone bodies and sugar in the urine This is much simplified by plac ing an indwelling catheter in the patient The carbon dioxide combining power and blood glucose levels should be obtained before beginning treatment and at 6 hour intervals thereafter until they are brought under con trol The intravenous administration of insu lin dextrose, water and salt affords preci sion control and should be used with atten tion directed to avoiding overloading of the circulation which is very easy to do in the older patient whose cardiac reserve is often low The routine taking of venous pressures at frequent intervals during the intravenous administration of fluids affords protection against this needless complication In severe acidosis ⅙ *M* lactate should be used in place of sodium chloride An acute febrile condition and the response to an operative procedure are usually accompanied by an intensification of the diabetes This should be anticipated and provided for The in dwelling catheter is most valuable during such periods

Immediate Preoperative Measures

A well instructed patient readily becomes a cooperative member of the surgical team All patients should have an idea about the sequence of events that they will be aware of They should have some understanding of the reasons back of these Such instruc tion combined with reassurance does much to remove apprehension This is aided by some form of sedation (barbiturate) 2 hours before the beginning of the anesthesia An hour later, an indwelling nasogastric tube is passed into the stomach the contents aspi rated and decompression maintained by constant gravity drainage Opiates are not used in these elderly patients preoperatively because they tend to depress respiration and with a fall of blood pressure that may occur the efficiency of the circulation is lowered Atropine alone is given 30 minutes before induction of anesthesia is begun The selec tion of various anesthetic agents is discussed in Chap 4

OPERATIVE PROCEDURES

In the surgical treatment of biliary tract disease in those over 65 the nature and the extent of the operative procedure employed should be determined for the most part by

the patient s capacity to withstand the burden it imposes An attitude that encourages flexibility and postpones *the decision until* the surgeon has all the information that bears upon it is a wise one to adopt An understanding of the postoperative complications common to this age group should surely influence the operator not to overburden his patient There is a great difference between those patients who have an acute process which has already consumed much of their reserve and those who have a nonacute condition and who have been carefully evaluated and well prepared for operation In the authors experience with 505 patients treated surgically for nonmalignant disease of the biliary tract there were 146 who had acute cholecystitis The great majority of these were admitted to the hospital quite ill The process was of varying duration and they were frequently markedly dehydrated *because of vomiting and inability* to take fluids Pain elevated temperature and infection also contributed to the over all picture of a depleted elderly individual whose meager physical reserves were greatly *diminished Under these circumstances or*gans and systems with impaired function are further reduced in effectiveness The local process such as an obstructive type of acute cholecystitis with ischemic necrosis may be on the verge of perforation The aged patient already depleted can withstand a surgical procedure that will avert this disaster far better than he can tolerate the burden of a local or generalized peritonitis Thus a cholecystostomy perhaps done under local anesthesia may well interrupt a course of events that could terminate fatally On the other hand the administration of a general anesthesia or even a high spinal and the removal of the gallbladder might be beyond the patient s capacity and death might follow The minimal procedure that will best ensure interrupting the immediate process should be carried out Later after recovery and preparation to reestablish reserve definitive surgery can be accomplished with a minimal morbidity of complications and mortality rate

Cholecystostomy

Of the 146 patients who were operated on for acute cholecystitis a cholecystostomy was done in 42 in 1 additional patient the common duct was also explored and drained (Table 20 2) As a group they were quite ill and for those who appeared to have little or no reserve, the cholecystostomy was done under local anesthesia (Fig 20 1) The gallbladder was first decompressed by aspiration and then the fundus incised and the calculi removed An impacted calculus in the ampulla of the gallbladder is frequently present in acute obstructive cholecystitis Its removal is most important because it can erode through into the common duct and result in partial or even complete obstruction Furthermore if jaundice is present owing to stones in the common duct diversion of the bile through the cholecystostomy cannot occur if the ampulla is blocked by a calculus

After removal of all calculi from the gallbladder a large (No 10 to 14) mushroom catheter is inserted into its lumen The wall of the fundus is snugged up about the catheter by a purse string suture The gallbladder wall is then sutured to the peritoneum and posterior rectus fascia of the abdominal wall If perforation has occurred prior to operation the defect may be used to evacuate the contents of the gallbladder and for the insertion of the catheter In addition the subhepatic area should be drained with two to three cigarette drains brought out through the abdominal wall inferior and lateral to the operative incision together with the mushroom catheter

TABLE 20-2 OPERATIVE PROCEDURES IN 146 PATIENTS 65 YEARS AND OVER WITH ACUTE CHOLECYSTITIS

Operative procedure	*No of patients*	*Deaths*	*Mortality per cent*
A Cholecystectomy only	77	7	9 09
B Cholecystostomy only	4	8	19 04
C Choledochotomy + A or B above	27	2	7 4
Total	146	1	11 6

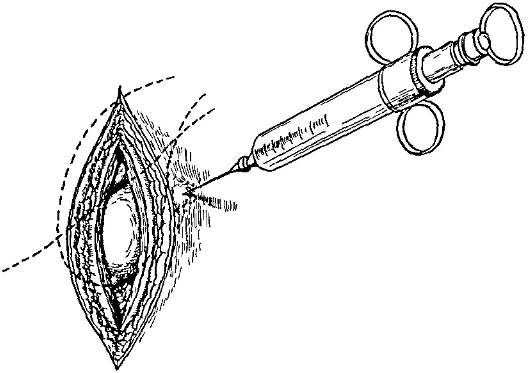


Fig 20 1 Cholecystostomy for acute cholecystitis performed under local anesthesia may avert disaster in the elderly patient who is seriously ill

The mortality rate for the 43 patients with acute cholecystitis subjected to cholecystostomy was 20 per cent This is indicative of the precarious condition of these patients Some were so ill that little hope of recovery was held, and yet many in this group survived in the face of what seemed overwhelming odds On the other hand several patients who although apparently lacking in reserve, were not greatly debilitated died following operation from coronary thrombosis renal failure or pulmonary emboli

There were several patients who were considered capable of undergoing a cholecystectomy so far as their general condition was concerned Most of these were operated upon under general anesthesia However when abdominal exploration revealed inflammatory reaction that rendered identification of structures difficult local peritonitis and abscess formation or the presence of pancreatitis only a cholecystostomy was performed The decision to do only a cholecystostomy can well be made before beginning an operation but the decision to do a cholecystectomy should not be made until the abdomen has been opened and the local findings determined Then and only then is the surgeon in the position to evaluate what the burden of the operative procedure will be in relation to the patient s over all capacity to tolerate it

Cholecystectomy

There are varied approaches and methods of removing the gallbladder The members of each surgical group will evolve the one that is most satisfactory to them It is believed that the following procedure is the least likely to be associated with injury to the common duct or hepatic vessels in the removal of the acutely inflamed gallbladder

Under anesthesia that permits good exposure and with adequate assistance the omentum that is usually adherent by fibrinous adhesions is reflected from the gallbladder A purse string suture is placed in the tense edematous wall of the fundus and a trocar introduced to evacuate the fluid contents With the gallbladder thus decom

pressed, calculi within it can be palpated and one is usually found impacted in the ampulla The gallbladder wall is now incised within the purse string suture and the calculi removed including the calculus or the mate rial within the ampulla The purse string su ture is then drawn tight and tied Attention is then directed to the region of the common duct and adjacent duodenum Varying de grees of edema and inflammatory reaction may render indistinct the structures in this area The peritoneum is incised parallel to the common duct in the region of its junc tion with the cystic duct The latter is identi fied and dissected sufficiently free to permit a ligature to be passed about it With tension placed upon this the dissection is carried cephalad and laterad about the adjacent gallbladder to expose the cystic artery This is likewise dissected free a ligature of silk passed about it and the vessel occluded by setting one knot just proximal to where the cystic artery bifurcates as it enters the gall bladder wall The peritoneum is then incised 1 cm from its junction with the liver about the entire gallbladder Beginning at the fun dus the gallbladder is dissected from its bed in the liver toward the ampulla Care is exercised to avoid injury to the liver enter ing into the lumen of the gallbladder is pref erable to penetrating the hepatic tissue However no gallbladder mucosa should ever be left If as sometimes is the case there have been perforations of the gallblad der into the liver the dissection may be tedi ous and difficult It may serve a useful pur pose to remove the purse string suture in the fundus and introduce an index finger into the lumen to serve as a guide in this ma neuver As the gallbladder is freed toward the neck portion the cystic artery becomes exposed as it bifurcates and enters the wall (Fig 20 2) The ligature previously secured with one knot is tied and the vessel divided Another ligature is placed proximally and the cystic duct dissected free down to its true junction with the common duct

The cystic duct may now be ligated if the common duct has been examined and the

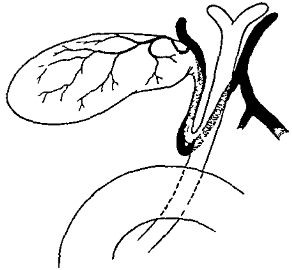


Fig 20 2 In very elderly and debilitated pa tients the authors have observed at operation that the right hepatic artery as it passes pos terior to the common duct follows closely the cystic duct to give off the cystic artery near the wall of the gallbladder It thus may be easily mistaken for the cystic artery Visualization of the cystic artery at its origin from the hepatic to its bifurcation in the gallbladder wall should be done before ligation and division

decision has been made not to explore it for calculi A 0 plain catgut ligature is placed about 0 5 cm from the junction and then just distal to this a transfixing suture of fine silk and the cystic duct is divided and the gallbladder removed No attempt is made to approximate the peritoneal cuffs that were developed in the dissection of the gallblad der from its bed If a good capsule remains and no cut has been made in the liver drainage from this area will be minimal The subhepatic area is drained by placing two cigarette drains along the course of the gall bladder bed with the tips just opposite the foramen of Winslow The opposite ends of the drains are brought out through a stab wound just below the costal margin in the anterior axillary line Seventy seven patients of the 146 with acute cholecystitis were treated by cholecystectomy alone There were seven deaths a mortality rate of 9 09 per cent These were the least ill of the entire 146 and considered to be the better opera tive risks by the surgeon In most instances

the deaths were directly associated with impairment of function of a system or an organ Infection at the site of operation was not a cause of death in any case Pulmonary infection in the form of pneumonia occurred twice in the early part of this period

If there are indications for exploration of the common duct this should be done in acute cholecystitis just as it is carried out when a cholecystectomy is performed for chronic biliary tract disease The decision to do a cholecystectomy should take into consideration that a choledochotomy may also be indicated In many instances this may be evident before the operation because of jaundice or a history of common duct obstruction It should also be kept in mind that the older the patient and the longer stones have been present in the gallbladder the greater is the incidence of choledocholithiasis It is equally significant that rarely are stones found in the common duct in association with acalculous cholecystitis In this group of 146 there were 21 patients with acalculous acute cholecystitis Among 27 patients subjected to common duct exploration 17 had common duct calculi and 10 had none This represents an incidence of choledochotomy of slightly more than 18 per cent and an incidence of recovered calculi in 12 per cent The authors believe that the common duct should be explored more frequently in patients 65 years and over, because as stated elsewhere the incidence of choledocholithiasis, as reported by others and as observed in the authors experience over the past 25 years increases perceptibly with each decade after 50 Certainly following cholecystectomy for cholecystitis with cholelithiasis the patients in this age group should be examined by intravenous cholangiography regardless of whether or not the common duct was explored Common duct calculi can be present without producing symptoms These should be removed when demonstrated because it is likely that they gradually increase in size and may become the cause of intermittent or complete obstruction of the common duct

If the common duct is to be explored when the cholecystectomy is done, then it is well either to leave the gallbladder attached to the cystic duct or to divide it near its junction with the cystic duct The common duct and its tributaries may be visualized by introducing 15 to 20 cc of 15 per cent Diodrast through the cystic duct and taking an x ray film on the operating table When the facilities for doing operative cholangiograms are available this is recommended However if special facilities and adequate personnel so that it can be done quickly and without unduly prolonging the operative procedure are not provided it should not be attempted in this older age group A linear incision 2 cm in length, is made extending from just below the junction of the cystic with the common duct toward the duodenum The ductal system is explored for calculi and a free passage should be demonstrated at the cho' dochal duodenal junction A frequent site of calculi in the common duct is just within the intramural portion A catheter or probe passed through into the duodenum serves as an aid in palpating for stones in this area Following choledochotomy the duct should be kept decompressed either by a catheter placed through the cystic duct stump or by a T tube placed through the exploratory incision In either instance a water tight closure of the duct will do much to prevent leakage of bile into the subhepatic area one of the most frequent complications associated with common duct exploration

Decompression of the ductal system following exploration should be maintained for 9 to 10 days in those 65 years and over Before removing the tube or catheter a cholangiogram should be made in order to demonstrate whether any calculi remain whether the sphincter of Oddi is patent and whether there is any evidence of neoplasm in the ductal system In the older age group who have a history of recent episodes of jaundice followed by acute cholecystitis calculi or neoplasm of the ductal system should be carefully looked for

In patients of this age group who have

undergone cholecystostomy a cholecystectomy should be performed when the condition warrants it The period of time required to get the elderly patient into optimum condition to undergo an elective procedure is variable Even after physical rehabilitation has been effected there may be considerable reluctance to embark upon another surgical procedure It should be explained to the patients and their relatives that stones may be expected to reform in a gallbladder within 2 years after a cholecystostomy and that they predispose to acute cholecystitis with its possible attendant complications and the likelihood of common duct calculi The authors are inclined to leave the cholecystostomy tube in place until cholecystectomy is done This serves a dual purpose first it obviates the possibility of another episode of acute cholecystitis second it serves as a constant reminder that the surgical therapy for the diseased gallbladder has not been completed

Chronic Benign Disease of the Biliary Tract

Three hundred forty-four patients were operated upon for chronic benign biliary tract disease They were evaluated after study and observation over varying periods After a decision had been made to operate many were specially prepared in an effort to enable them better to withstand surgery In the first half of the 25 year period perhaps an equal number of patients comparable in most aspects were observed but were not operated upon There were several reasons for this First was the attitude of the patients and their families It was not unusual for elderly patients to come to the outpatient department or to be referred to the surgical pavilion because of abdominal pain and gastrointestinal symptoms Study and examination would establish the diagnosis of biliary tract disease Possible surgical treatment would be discussed The patients then over 65 had few remaining peers so far as age was concerned They knew few who had survived an operation of any kind and they would often recall that some friend had died in a hospital As a group they were fearful of embarking upon what was to them the unknown Family members particularly the husband or wife would assume the attitude that they would prefer to live with the symptoms and disability as long as possible rather than risk an operation As surgeons the authors were well aware of an increased morbidity and mortality rate but were not sure just where it rested They did not feel justified in insisting on operation It was not unusual therefore to discharge such patients from the hospital with instructions which it was hoped would keep their symptoms under control and to advise them to return if they became worse Many of these patients did return with an acute obstructive type of cholecystitis They were often dehydrated in electrolyte imbalance in cardiac failure or in an exacerbated state of diabetes on an arteriosclerotic basis Some would improve but others would become worse and surgery would become imperative It thus became evident that these patients could have been treated surgically with greater safety when they were first evaluated With an increasing experience with this problem the authors became more bold in recommending operation Their present attitude is presented to the elderly patient with gallbladder disease somewhat as follows You have been suffering from symptoms caused by biliary tract disease Yes there is a possibility that it may be cancer but it is not very likely By operation we believe you have an 85 to 90 per cent chance of being markedly improved There is risk associated with all surgical procedures the risk being slightly greater in the elderly than in the younger and more robust However we are aware of the situations that predispose to complications and with preparation before and special care during and after operation you should have almost an equal chance of having little or no difficulty Many patients of your age and older are being benefited by surgical operations in this and many other hospitals every day If nothing is done you may develop

complications such as an acute cholecystitis or an obstructive jaundice, that may necessitate an operation under much less favorable circumstances At the same time there are many more of the older age group in the hospital and these patients have an opportunity to see and talk with them, learning at first hand, if they do not already know, that age is no justification for neglect so far as surgical therapy is concerned As consultants the surgeons see patients who have been studied for one reason or another and have been found to have biliary tract disease Many of these have originally been looked upon as suffering from heart disease They may have a cardiac condition but they sometimes also have biliary tract disease that manifests itself by recurrent attacks of biliary colic or acute cholecystitis These in turn may precipitate cardiac arrhythmias angina or episodes of auricular fibrillation Removal of a gallbladder with stones may be followed by a decrease in cardiac symptoms It should be stressed that elderly patients with cardiac symptoms and electrocardiographic changes associated with biliary tract disease should be carefully studied before embarking on surgery and the exact status of the heart determined so far as it is possible to do so If cardiac abnormalities are demonstrated or strongly suspected then the preoperative preparation selection of anesthesia and operative management should be based on the realization that the risk is greater and that increased precision in management is essential

The mortality rate for 344 patients is this age group operated upon for chronic biliary tract disease was 3 4 per cent Two hundred nine were treated by cholecystectomy alone with mortality rate of 1 9 per cent This is higher than the over all mortality rate for elective cholecystectomy which in the authors experience was 0 6 per cent for 3 117 patients All but 12 of these patients had gallstones The acalculous gallbladder is now rarely looked upon by the authors as an indication for cholecystectomy and if encountered at operation, prompts us to seek another explanation for the presenting clinical picture

Eighty-seven patients had both cholecystectomy and common duct exploration For this group the mortality rate was 4 59 per cent, which is very little higher than for the entire experience with this combined procedure in the chronic phase For the total number of 296 patients who had cholecystectomy 87, or 29 per cent also had exploration of the common duct Stones were recovered in 71 per cent In the early part of the 25 year period, the authors were reluctant to explore the common duct and believed that the incidence of choledocholithiasis was less than they have now concluded it to be They believe that they left stones in the common duct because of this policy At present they think that the indications for common duct exploration in this age group are present in more than 60 per cent The mortality that was associated with obstructive jaundice before the introduction of vitamin K by Dam in 1935 has now been almost entirely eliminated and the authors have not recorded a single death as attributable to the bleeding tendency due to obstructive jaundice in either the older or the younger age groups Common duct exploration can be combined with cholecystectomy with little increase in risk It should be done only on indication in the authors opinion but when embarked upon should be done with a thoroughness that is encouraged by a conviction that calculi are present This does add to the operative burden by increasing the operative time and manipulation of the viscera in the right upper quadrant One must bear in mind, also that a common duct calculus may be present and cause few symptoms and then upon removal of the gall bladder may cause immediate and complete obstruction When this situation obtains the possible complications are numerous Because the incidence of common duct calculi increases with age it is important to perform a *choledochotomy* and search for

stones even though the indications may be so scant that they would not arouse suspicion if seen in the much younger patient Since all common ducts explored in the authors practice are drained by catheter or T tube the elusive and undiscovered calculus is rendered less hazardous

Cholecystostomy for chronic gallbladder disease was performed 13 times in this group There is no longer any justification for this procedure and it has not been performed over the past 15 years Before then it was considered that the removal of stones from the gallbladder in elderly patients would provide them with relief for the remainder of their life expectancy With the tendency of calculi to form within 2 years following cholecystostomy in 50 per cent or more of patients cholecystectomy should be the procedure except under most unusual circumstances Cholecystectomy for chronic cholecystitis and cholelithiasis is performed by the authors in the same manner as acute cholecystitis save that decompression by trocar aspiration is seldom necessary The gallbladder may of course be removed by dividing first the cystic duct and then the cystic artery and dissecting the gallbladder from its bed in the liver in retrograde fashion In either approach the most essential steps are those that provide for the unequivocal identification of any and all structures before division Injury to the common duct or the hepatic artery is withstood no better by patients 65 and over than by those who are younger Drainage of the subhepatic area is never omitted It is a simple protective measure directed at the control of an unpredictable complication the accumulation of blood and/or bile in this region

Choledochotomy for calculi a secondary operation 1 month to 30 years after cholecystectomy was performed in 35 patients and calculi were recovered in 30 or 85 per cent Whether all these were calculi that had been overlooked at a previous operation or whether they formed following cholecystectomy or removal of all previous existing common duct calculi remains an unanswered question From the authors experience in performing secondary operations on patients upon whom they performed the primary operation they are inclined to believe that most of the calculi were in the overlooked category

In elderly patients both those with calculi and those without the authors have encountered on common duct exploration an occasional example of narrowing of the intraduodenal portion of the common duct This is not simple spasm of the sphincter of Oddi but a true narrowing with scar tissue When confronted with this situation it is the authors present practice to open the duodenum and establish beyond any question that the terminal portion of the common duct is narrowed and that simple sphincterotomy will not relieve the obstruction The common duct is then divided just proximal to its junction with the duodenum and the proximal segment anastomosed end to end to jejunum of the Roux Y type employing an 18 in segment The lower end is closed with a series of inverting mattress sutures

Biliary Enteric Fistulas

On rare occasions in the course of operation for chronic biliary tract disease in the elderly a biliary enteric fistula is found unexpectedly The gallbladder disease is usually of long standing and there is a history of recurrent episodes of acute right upper quadrant pain not always but frequently followed by jaundice that disappears after a few days Attempts at cholecystography seldom result in visualization of the gallbladder The astute roentgenologist may make the diagnosis before operation by recognizing air in the biliary ductal system He may confirm the diagnosis by demonstrating the communication between the intestinal tract and the gallbladder or common duct By far the most common site of these fistulas is between the fundus of the gallbladder and the duodenum or jejunum They are a sequela to an acute obstructive type of cholecystitis that progresses

to gangrene of the ischemic portion of the gallbladder fundus The adjacent intestinal wall becomes adherent to the inflamed gallbladder, sustains necrosis of its wall and receives the contents of the distended gallbladder, including the gallstones Gallstones thus evacuated into the duodenum or jejunum may be large enough to become lodged in the terminal portion of the ileum and cause intestinal obstruction Many more pass through the fecal stream without being noticed

When a biliary enteric fistula has existed for months or years, it will be found at operation that the gallbladder is as nicely anastomosed to the intestine as if it had been done by a meticulous surgeon The gall bladder wall is much thickened but the organ is flaccid and well decompressed The common duct is frequently larger in diameter than is normal, and its wall is grossly thickened The common hepatic portion of the duct proximal to the cystic duct is readily compressible, while the common duct distally may be partially or completely filled with calcareous material When the common duct is incised below the level of the cystic duct the impacted sandlike material may appear as a cast It is readily broken up and removed from the portion about the duodenum The intraduodenal segment of the common duct may be difficult to clean out and a transduodenal approach to the ampulla of Vater may be necessary to reestablish its patency

The biliary enteric fistula discovered unexpectedly at operation that involves the stomach duodenum or jejunum can be dealt with forthwith The communication between the biliary tract and the gastrointestinal tract is divided, and the defect in the intestine is repaired by a series of inverting sutures placed transversely at right angles to the axis of the intestine so as not to diminish its lumen A cholecystectomy is then performed as described above The common duct is explored all calcareous material removed and the patency of the choledochal duodenal junction established The common duct is then drained by a T tube

CASE REPORT No 6 (N Y H No 316388)

Cholecystoduodenal fistula anemia and hypertensive cardiovascular disease Sex female age 79

Present illness For many years the patient had had epigastric and right upper quadrant pain occurring after meals She had also had episodes of gastrointestinal bleeding Twelve years previous to this admission a large gastric diverticulum and gallstones had been demonstrated The patient had hypertension of many years duration Recently she had been on *Rauwolfia serpentina* and reserpine

Physical examination Temperature 37 C pulse 110 blood pressure 225/98 respirations 20 per minute The patient was an elderly white female not acutely ill There were hypertensive changes in the eyegrounds and there was a systolic murmur over the apex of the heart

Laboratory examination Hematocrit 29 Stools 1 to 4+ on guaiac examination Gastrointestinal series large gastric diverticulum Barium enema diverticulosis of the colon

The admission diagnosis was (1) gastric diverticulum (2) cholelithiasis (3) hypertensive cardiovascular disease

Course The patient s blood volume deficit was corrected with packed red blood cells Three weeks after admission laparotomy was carried out The gastric diverticulum was excised There was no evidence of ulceration on the mucosa The gallbladder was small and shrunken and densely adherent to the duodenal wall Examination after dissection revealed a large cholecystoduodenal fistula and no stones in the gallbladder The common duct was explored and drained No calculi were found

The gallbladder was removed and the cholecystoduodenal fistula closed It was assumed that all the stones seen in the gallbladder 12 years previously had passed into the intestinal tract through the fistula Ten days after operation it became evident that the operative wound was infected The wound was opened up and a culture taken which revealed *Pseudomonas aeruginosa* and *Proteus vulgaris* The wound

granulated and closed slowly Three weeks after operation the patient had an episode of orthopnea and cyanosis Moist rales were present at the base of both lungs Following this the patient was digitalized Recovery was slow but the patient was discharged 2 months after the operation During the year following the patient's discharge there has been no evidence of gastrointestinal bleeding The epigastric and right upper quadrant pains have also disappeared

If the biliary enteric fistula involves the hepatic flexure of the colon and there has been no preparation of the bowel then it is probably preferable to leave it unmolested, terminate the operation and return when the bacterial flora of the bowel has been greatly reduced by chemotherapy and other measures used to reduce the hazard of peritonitis when the colon is opened

Acute Intestinal Obstruction Due to Gallstones

The authors have cared for several patients in this age group who had acute intestinal obstruction from gallstones passed from the gallbladder through the newly formed biliary enteric fistula The stone or stones sometimes fused together become lodged in the narrow portion of the ileum This occurs sufficiently frequently among the elderly that when intestinal obstruction is present the possibility should be considered The diagnosis is most often suggested by the history and confirmed by flat plate roentgenogram of the abdomen The patient is usually seen when the intestinal obstruction is quite evident The immediate episode of illness may be of several days duration having begun with pain in the right upper quadrant and midepigastrium The patient's past history often includes the symptoms of long standing biliary tract disease They may or may not know that they have gallstones but many have been correctly diagnosed Attacks of acute obstructive cholecystitis and biliary colic have occurred at various intervals The present attack has differed from others in that it has been more severe whereas the earlier episodes usually subsided after 30 to 48 hours this one has persisted There has been nausea vomiting and generalized abdominal pain Then a new sign has developed abdominal distention As this has increased and the patient has become more uncomfortable the nature of the vomitus has changed from one that is clear odorless and bile stained to one that is brownish and redolent of feces Because of the intestinal obstruction the patient's general discomfort and restlessness are different in character from that of the patient with acute cholecystitis or intraperitoneal infection

The information obtained from an x ray of the abdomen composes a triad that is pathognomonic of gallstone ileus namely (1) air in the biliary tract (2) gallstone in the terminal ileum (3) dilated and distended small bowel

These individuals not only are very ill but also are depleted and have little reserve so far as physiologic function is concerned They require immediate and meticulous care Intestinal decompression by an indwelling nasogastric tube precise correction of water and electrolyte differences and supportive measures to other systems are indicated before operation which should be undertaken as soon as the patient's condition permits The operative procedure should accomplish one thing relief of the intestinal obstruction Nothing additional should be attempted

Operation for Gallstone Ileus

Under adequate anesthesia general or local the abdomen is opened directly over the location of the gallstone within the intestine if it has been visible on x ray examination If it has not then a lower right rectus muscle reflection incision is employed The dilated proximal intestine is demarcated from the collapsed distal bowel at the site of the obstructing gallstone If the bowel is viable and the calculus can be displaced by gentle manipulation into the dilated bowel then it may be removed by an enterotomy

incision parallel to the axis of the bowel If the intestinal wall about the obstructing stone is not viable or has a perforation as is sometimes found, then that segment of intestine should be resected, and the continuity re established by an end to end anastomosis It is the authors firm conviction, based upon their own experience as well as upon the reports of others that no attempt should be made to correct the biliary enteric fistula or even to visualize it The mortality rate for such attempts is high because the older pa tients have been acutely ill for variable periods of time and their capacity to with stand the burden of any operative procedure has been greatly diminished The most effi cient and elaborate preparation that can be provided within the short time before an operation is undertaken for acute intestinal obstruction does not approach maximal restoration The objective is to preserve life This can best be done by keeping the opera tive burden as small as possible and yet relieving the intestinal obstruction The forma tion of the biliary enteric fistula is nature s response to a catastrophic situation necrosis of the wall of the obstructed and distended gallbladder, preventing peritonitis It should be left unmolested until the patient s general condition has improved sufficiently that he may be considered capable of tolerating a major surgical operation Then protected by planned preparation including prophylactic chemotherapy the risk can be anticipated as minimal There may be some for whom the risk of operation will remain greater than that of possessing a biliary enteric fistula

Suppurative Cholangitis and Intrahepatic Abscess

Following common duct exploration and other operative procedures among the older patients who have sustained liver damage from long existing gallstones and associated infection of the biliary tract suppurative cholangitis and intrahepatic abscess may develop Prior to the introduction of the antibiotic drugs this complication was almost always fatal Their judicious use before, during, and after operation can prevent it If identification and sensitivity of the causative organism can be established, selective and specific therapy may overcome the infection When an elderly patient who is jaundiced and who has been running a febrile course is found at operation to have gallstones and common duct stones with a liver that shows scarring of biliary cirrhosis, he should be considered a likely candidate for this com plication In an effort to prevent this special measures should be taken, including the following

The manipulation of the ductal system should be kept at a minimum Distention of the ductal system by introducing radiopaque material for cholangiography as well as force ful irrigation to flush out stones should not be done

Pressure upon the liver by retractors or palpation should be avoided

Material for bacterial culture should b taken from (1) bile (2) gallbladder wall (3) common duct wall (4) liver by biopsy These cultures should be carried through as quickly as possible so that all organisms susceptible of identification may be identified and so that sensitivity tests may be per formed to determine what antibiotics should be most effective in their control

Generous common duct decompression should be assured by means of a T tube that is secured by suture to the wall of the duct and is in diameter slightly less than that of the choledochus

The T tube should be left in place for at least 2 to 3 weeks while appropriate indi cated chemotherapy is maintained Only after all signs of infection have receded should a postoperative cholangiogram be made Par ticular care should be exercised to visualize such a biliary tree in order that the ductal system not be distended by introducing the opaque material under pressure

Infarction and necrosis due to thrombosis of arterial supply to segments of the liver may occur in conjunction with suppurative cholangitis and multiple abscess formation Fairly large abscesses may form as a sequela

to infarction and necrosis as well as by the confluence of multiple small abscesses These are difficult to recognize but they should be suspected when the manifestations of massive infection including high fever and marked leukocytosis, are present without evident explanation or cause

POSTOPERATIVE CARE AND MANAGEMENT

Postoperative Gastric Decompression

Following operations upon the biliary tract in all age groups an unpredictable but fair proportion of patients will have nausea and vomiting unless the stomach is kept empty by constant decompression Vomiting is a disturbing experience for anyone and in the aged it may be devastating It causes increased wound pain and results in diminished depth of respiration Aspiration of gastric contents into the trachea and bronchial tree may lead to serious pulmonary suppuration The indwelling nasogastric tube is quite effectual in preventing nausea vomiting and aspiration of gastric contents but many of the elderly patients object to it strenuously Its presence is continuously uncomfortable Accumulations within the bronchial tree and trachea are very difficult to raise with the tube in place The atrophic mucous membranes of the esophagus and the nasopharynx probably account for some of the increased sensitivity that these patients experience It may also explain the rapidity with which ulceration may occur in the esophagus with such a tube in place The authors have observed ulceration from the ordinary small rubber tube that was within the esophagus for only 24 hours This was painful for a few weeks thereafter and healing was followed by a stricture in the middle third of the esophagus For these reasons following operations upon the biliary tract other than cholecystostomy in the geriatric group the authors have come to use frequently a transabdominal gastrostomy that has been performed deliberately through a very small incision

Transabdominal Gastrostomy

After the completion of the operative procedure upon the biliary tract the freely presenting anterior wall of the stomach just to the left of the midline is visualized by retraction of the medial aspect of the wound Two sutures of medium silk about 2 cm apart are placed through the stomach wall to include the submucosa but not the mucosa and a purse string suture of 0 chromic catgut is then placed in the wall just within the silk sutures At the approximate site where this part of the stomach wall rests in relation to the abdominal wall a stab incision is made through the skin fascia rectus muscle and peritoneum Then a Kelly clamp is inserted from the skin surface and a No 14 Foley catheter with a 5 cc inflatable bag is drawn through An incision is then made in the center of the area encompassed by the purse string suture to open into the stomach The Foley catheter is inserted the balloon distended with 5 cc of water and the purse string suture snugged up about it and tied Silk sutures with needles attached are now passed through the peritoneum and posterior rectus fascia to secure the stomach wall firmly to the abdominal wall The catheter is thereafter maintained on gravity drainage for 12 to 24 hours (Fig 20 3) Then if there is no nausea when liquids are given by mouth it is clamped and kept occluded unless there is anorexia or vomiting The Foley catheter is left in place for 4 to 6 days to insure complete sealing of the gastric serosa to the abdominal peritoneum then the distended balloon is deflated and the catheter removed The elderly patients are grateful for this type of gastric decompression which was introduced to the authors by Dr R K Gilchrist of Chicago The authors have observed that patients on their surgical pavilion discuss with one another the various incidents of their experiences relative to their operations The elderly patients are agreed that an indwelling nasogastric tube is one of the most disturbing and uncomfortable experiences they are asked to tolerate while in the hospital

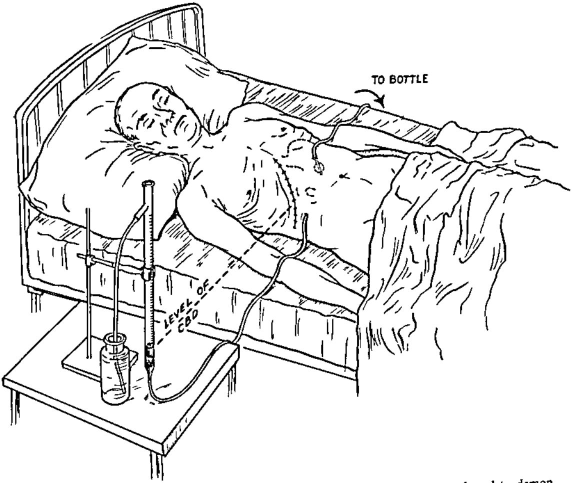


Fig 20 3 Bedside buret attached to common duct drainage tube is employed to demonstrate patency of choledochoduodenal junction Foley catheter type of temporary gastrostomy for gastric decompression is better tolerated by elderly patients than a nasogastric tube

POSTOPERATIVE COMPLICATIONS

The incidence of complications following surgery upon the biliary tract as reported by many others as well as by the authors, is higher among the elderly than among the younger patients This difference holds about equally for those complications that may be directly associated with the operation and the biliary tract and those that appear to be more indirectly related occurring in other systems or organs As to the first the duration of biliary tract disease and its extent are generally of greater magnitude than in the young There is more often scarring and damage to the liver with a diminished functional reserve Common duct calculi and changes in the lower segment of the choledochus that result in its narrowing are also more frequently present As to the second preoperative evaluation has demonstrated that cardiovascular disease hypertension coronary sclerosis renal impairment diabetes and emphysema exist singly or in combination in well over half the patients with biliary tract disease 65 years and over It is evident therefore, that complications that have their basis in any of these would be much greater than among those who did not exhibit changes or diseases that are primarily linked with old age and are viewed as being of a degenerative nature

One might reason on first survey of this problem that the composite of these data is evidence against surgical treatment of biliary tract disease or of any other condition in this group Even without the benefit of the analysis of long clinical experiences this was

the basis of the attitude that surgical therapy was most effectual in the young and robust and that it curtailed life rather than prolonged it in the aged and debilitated It is now quite evident that this attitude has changed greatly over the past 25 years Many factors are responsible for this reversal not the least of which are the advances made in surgery in general and the ever increasing number and proportion of the population who live into the older age category

Equally important has been the realization that biliary tract disease untreated surgically is a frequent cause of death either by slow, insidious damage to the liver or more suddenly from those complications that are incompatible with life if uncontrolled such as peritonitis obstructive jaundice and sometimes cancer Surgical therapy has always been looked upon as elective except in trauma and in certain emergent situations It is not always accepted even when the indications are quite clear For reasons often justifiable particularly from the patient s point of view procrastination postponement and frank rejection of surgery are not infrequent A few years ago the authors reviewed a series of patients who had been hospitalized because of biliary tract disease during a 21 year period and upon whom for one reason or another surgery was not carried out at that time They found that this amounted to 3 to 4 per cent of those under 50 years of age 7 to 8 per cent of those between 50 and 64 and almost 20 per cent of those 65 years and older In a somewhat similar study Fisher and White reported that 50 per cent of geriatric patients with biliary tract disease were treated without surgical intervention

Complications Directly Associated with the Operative Area

Wound Infections

Though they do occur wound infections are no more frequent in the geriatric group than in those who are younger An increased elevation of temperature after the second or third postoperative day or local pain and discomfort in the wound with or without inflammatory reaction in the skin is indicative of wound infection This may be limited to the subcutaneous tissue and be extrafascial or it may involve the muscle layers and be extraperitoneal These are readily controlled by chemotherapy or if suppuration has taken place opening of the wound with the removal of sufficient sutures to provide adequate drainage This type of wound infection has occurred so rarely in the authors experience that they do not think that this possibility justifies the routine use of chemotherapy for biliary tract operations

Extensive wound infections may result in dehiscence and protrusion of viscera If dehiscence occurs involving only a part of the wound the patient should be taken to the operating room and the entire wound opened and then closed with through and through silver wire (gauge 14) without any attempt to approximate the skin with sutures

Subhepatic Accumulation

Division of small bile channels near the proximal portion of the gallbladder or injury to the liver by removal of the gallbladder bed or cutting into it during a cholecystectomy gives rise to the accumulation of bile in the subhepatic area Inadequate hemostasis in combination with this results in collections that can cause a serious complication if they are unable to escape through a drain If they persist and infection flourishes they tend to extend both anteriorly and posteriorly to result in a subdiaphragmatic abscess In the aged the systemic response may not be as apparent or as striking as in younger persons However discomfort in the operative area anorexia or increased discomfort on exaggerated inspiration and on deep palpation laterally or posteriorly just below the liver margin may indicate such a process If the process has extended into the space between the liver and the diaphragm then x ray and fluoroscopic examination will reveal an elevated diaphragm with partial to complete limitation of movement The immediate es

tablishment of free drainage is indicated, as well as all other measures to combat extending infection

Jaundice

The onset of jaundice following cholecystectomy is always of grave concern Particularly in the older patient this is most frequently due to calculi in the common duct Such patients may have given no history suggestive of choledocholithiasis, and indications for exploration of the common duct may not have been evident at the time of operation The patient may never have had any previous signs of common duct stone, nevertheless, they are present Following cholecystectomy there may be spasm of the sphincter of Oddi, or there may occur other changes within the ductal system so that calculi now cause obstruction Jaundice that appears after the second or third postoperative day and is either intermittent or persistent is quite likely the result of a common duct calculus If intermittent intravenous cholangiography should indicate its presence If the jaundice is persistent and increasing operation should be undertaken Jaundice that begins immediately after operation and is persistent or becomes more intense is indicative of injury or distortion of the common duct A period of observation is indicated unless the obstruction is complete In such an event there is increasing discomfort in the hepatic area the jaundice becomes more intense rapidly the pulse is elevated and there is usually some febrile response Exploration and decompression to prevent further liver damage should be done without delay

Jaundice that occurs after the immediate postoperative period may be caused by viral hepatitis, usually resulting from blood transfusion although sometimes contracted in other ways Common duct calculi still are the more likely cause If the patient s course is as described by Charcot, i e pain occurring in the right upper quadrant or midepigastrium and radiating through to the back followed by chills, fever and jaundice that subsides to recur again then the diagnosis is well established

From time to time the authors have seen patients who have been operated upon for presumed cholelithiasis and choledocholithiasis because of symptoms typical of gallbladder disease and a history of a mild and intermittent icterus At operation the surgeon has found an enlarged gallbladder with gallstones He has explored the common duct and recovered no calculi He has demonstrated a satisfactory patency of the choledochoduodenal junction The gallbladder has been removed and the common duct drained with a catheter or T tube A postoperative cholangiogram has been reported within normal range and the tube is removed and the patient discharged from the hospital Within a few days the patient has become mildly jaundiced Re examination shows bile in the stools and not infrequently occult blood The jaundice may fluctuate but it tends to increase Re exploration reveals a carcinoma of the common duct of an invasive nature that gradually diminishes the caliber of the lumen but only in its late stages completely occludes it

Pancreatitis

Acute pancreatitis following operations upon the biliary tract is relatively uncommon but does occur often enough so that it should be kept in mind among the older patients when they develop severe epigastric pain that extends substernally and through to the back in the first 48 hours after surgery An accompanying elevated pulse elevated serum amylase and lowered blood pressure progressing toward a shocklike state may be difficult to distinguish from a coronary occlusion Electrocardiogram and serum amylase determinations are aids in differential diagnosis Certainly conservative management will result in recovery in most instances It would seem that this applies to those patients who have had common duct exploration and drainage combined with cholecystectomy If however cholecystectomy alone has been done and acute pancreatitis de

velops then because of the high incidence of cholelithiasis common duct exploration and decompression may be indicated Acute jaundice that accompanies acute pancreatitis is more often due to calculi than to compression of the duct by the inflammatory process

Hepatic Insufficiency (Cirrhosis Infection and Necrosis)

In the older patients reduced liver reserve is responsible for a fair proportion of the fatal complications Injury to the liver from long standing biliary tract disease plays an important role but in addition in this same group of patients there are pulmonary changes associated with emphysema and pulmonary arteriolar sclerosis Pulmonary hypertension and right heart failure may be the direct cause for liver failure when the reserve has already been reduced Lacking satisfactory measures by which to estimate liver function reserve it is well worthwhile to consider that it is reduced in all elderly patients The cirrhotic liver with long existing infection within the fine biliary radicles tolerates poorly an acute flare up that may be initiated by an operative procedure Superimpose at the same time hepatic venous congestion from right heart failure and the result may equal that of a physiologic hepatectomy In the poor risk patient the magnitude of the burden of an operative procedure may determine whether or not he survives The surgeon must ever be aware that the maximum burden of a surgical procedure in the geriatric group is not during the actual operation but during the 24 to 48 hours or more thereafter The duration of the procedure the extent of the trauma to tissues the toxic effect of medications and anesthesia as well as other factors contribute to a cumulative burden that may overtax the capacity of the patient in the postoperative period although the course of events during the actual surgery was parallel to that in a young and robust patient An awareness of this will prompt the surgeon to select the minimal procedure that will meet the immediate circumstances whenever there is any doubt

Several measures are available that are of value in combating problems relative to the injured liver Antibiotics penicillin and streptomycin have been demonstrated to be effective in controlling intrahepatic infection When there is evidence of cholangitis acute chronic or recurrent or when common duct obstruction is present the extent of a flare up of infection following surgery may be kept at a minimum by the prophylactic use of these antibiotics Overloading the circulation by intravenous fluids including blood transfusions continues to occur in many hospitals This is poorly tolerated by the patient who has marginal cardiac reserve and pulmonary hypertension One must guard against pulmonary edema as well as respiratory pulmonary complications that can so readily develop following anesthesia and/or an upper abdominal operation Atelectasis whether attributable to anesthesia or to lack of activity can be prevented best by those who have an understanding of its genesis Actually the course of events not too infrequent 25 years ago of postoperative atelectasis pneumonia and overwhelming infection is rare today

Pulmonary Emboli

The blood vessels and the cardiac function of the geriatric patient account for an incidence of pulmonary emboli that is higher than in younger individuals Varicose veins and deep veins of the lower extremity with changes within their walls and even partial occlusion are the favorite sites for the formation of thrombi Contributing to the pooling of blood in these areas is the reduction in blood pressure that often takes place in older persons when given narcotics and anesthetic drugs

Position and Reduced Muscle Activity

Overmedication both before and after operation and the use of extreme positions on the operating table must be avoided Frequent turning of the patients in bed with flexion and extension of the lower extremities together with deep breathing exercises as soon as they begin to recover from the anes

thesia combined with early mobilization, can keep this complication an infrequent one

Early Mobilization after Operations upon the Biliary Tract There is a long existing tendency among the laity, not entirely lacking within the professional circles of our hospitals, to keep the patient as quiet as possible after operation The shorter the period of inactivity the less invalidism and the fewer complications there will be This can best be accomplished by explaining to the patient before operation what the objectives of the procedure are and what it entails so far as he is concerned To those patients about to undergo a cholecystectomy or cholecystostomy with or without a common duct exploration the authors present the over all plan of procedure They are told that they will go to sleep following an injection in the arm (Pentothal anesthesia) and that this is not unpleasant Once under anesthesia the operative procedure that will be done will depend upon what is found and what seems best for the individual patient's problem Because the gallbladder and liver are in the upper right abdomen the incision will be placed there A drain will be brought out to the side of this and if a small rubber tube is needed to drain off bile from the biliary tract, it will be brought out through the same site or a nearby one When they awaken, they will have pain in the incision when they move, but this will be controlled by medication if it is severe The importance of deep breathing as soon as they awaken is stressed Also emphasized is the necessity to raise anything from their trachea by coughing They are assured that the integrity of the wound will be dependable and that coughing and moving about will be well tolerated They are also told that they should flex and extend their legs and that as soon

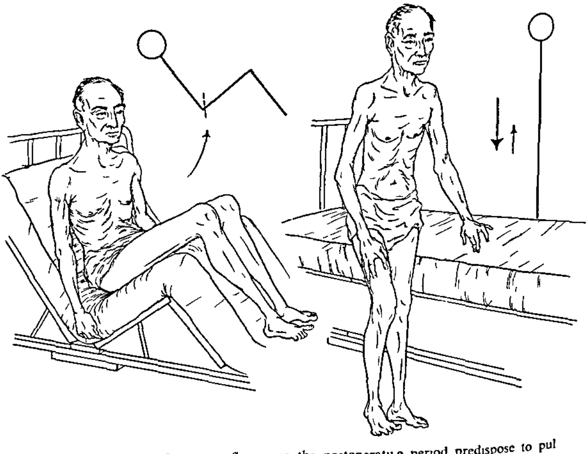


Fig 20 4 Positions of extreme flexion in the postoperative period predispose to pulmonary emboli and are to be avoided Early mobilization and minimal flexion that is comfortable is recommended

as they have recovered sufficiently from the anesthesia they will be helped to stand at the edge of the bed for a few minutes and to take a step or two The advantages of the standing position in improving motion of the diaphragm with better aeration of the lungs and increased blood flow to the lower extremities are explained (Fig 20 4) Such instructions concluded with assurance that they are going to be taken good care of by a team pave the way for the cooperation in the early postoperative period that is so important in avoiding postoperative complications

Once a patient has been assisted to get out of bed to stand and to take a few steps *he realizes it is well within his capacity to* repeat the process from that time on the majority become less dependent upon our diminishing nursing personnel Early mobilization after operation has done much to reduce *invalidism following surgical procedures* and this is reflected in shortened periods of hospitalization Even more important in the older patients it reduces complications and demonstrates to them that they have a capacity for taking care of themselves A carefully explained plan does much to diminish the fear and apprehension that go with the unknown It gives the patient a specific part to play and diverts him from feeling that he is being asked to do too much or indulging in misinterpretation of ordinary procedures as indicative of a fatal outcome

The older the patients are the greater is their realization that their life expectancy is limited In their minds many surgical operations are associated with death or the early phases of a terminal illness Seldom will these patients voluntarily reveal this background to the surgeons in attendance It may be well however to consider that this situation obtains almost universally and that it is continually reserved and thought about during the hours of the night when many of them are unable to sleep The capacity of persons to be informed about their problems under such circumstances varies greatly from one to another Part of the art of surgery is to evaluate this and to utilize it fully in lessening the over all burden of a surgical operation upon the patient

THE ASYMPTOMATIC GALLSTONES OR BILIARY CALCULI IN THOSE 65 AND OVER

The gradual increase in the proportion of our population 65 and over has been constant for several years The average life expectancy for those born in 1956 is 70 years whereas in 1900 it was 50 years a difference of 20 years Each year sees a greater number reaching what we call the extremes of age 95 and older The incidence *of gallbladder disease is estimated at 10* per cent for our entire population It is relatively rare before 20 and increases decade by decade thereafter A great many individuals with biliary tract disease are operated upon before they reach 65 because of symptoms and disability At the present our most effectual means of correcting or interrupting biliary tract disease is by surgical therapy It is generally agreed that satisfactory relief of symptoms believed to be caused by gallstones and their sequelae is obtained in 85 to 90 per cent of those operated upon The indications for surgery in patients with gallstones that are producing symptoms are clear cut The problem of gallstones that are not causing symptoms remains controversial The crux of this question centers about the difference between the risk of operation and the risk of calcareous biliary tract disease The risk of operation has always been greater in elderly patients and this obtains at present The over all mortality rate for operations upon the biliary tract 50 years ago has been estimated at over 10 to 15 per cent This was reduced to nearly 5 to 10 per cent 25 years ago The over all mortality in this country for 1956 is estimated at about 3 to 5 per cent The number or proportion of individuals over 65 years has gradually increased over the past 25 years The mortality rate for these has been reduced but it is higher than in the younger age group

Over the past 2 decades reports from several medical center hospitals have shown extremely low rates of morbidity of postoperative complications and mortality among patients under 50 years of age operated upon for chronic benign biliary tract disease Considerable numbers have been operated on consecutively without a single death The risk, as reported from these same clinics, is only slightly higher for those from 50 to 64, but considerably higher for those 65 and over The greatest risk in operation is clearly centered in the older group The authors lack figures to compare these results with those in patients with biliary tract disease who may have been incorrectly diagnosed, not treated surgically or both There can be little controversy over a policy that provides for the early surgical treatment of biliary tract disease soon after gallstones are formed and in the younger years of life

In those 65 and over there is an increasing trend toward early operation for those conditions where an acute and fulminating process has become established Acute obstructive cholecystitis and common duct obstruction are examples Likewise in chronic biliary tract disease with recurrent attacks of pain and indigestion the relief afforded by operation is largely considered by the medical profession to warrant the risk involved There is also an increasing realization that in this older age group chronic recurrent symptoms are not infrequently a forerunner of complications that require surgical correction The trend toward the surgical treatment for biliary tract disease in the aged is rapidly approaching that so well established for the younger aged group

There remains the problem of what constitutes the optimum management of the patient 65 and over who has been demonstrated to have gallstones by cholecystography or whose gallbladder is not visualized even by several attempts It is a fact that at postmortem examinations many individuals in the older age group have been found to have calculi within the gallbladder and the ductal system yet so far as can be determined they had no symptoms of biliary tract disease Autopsy also reveals carcinoma of the gallbladder with gallstones where symptoms were present only in the terminal phase of the cancer Then there are all gradations of liver damage and biliary cirrhosis that seemingly have not caused symptoms Only occasional reports attribute death to an unsuspected primary disease of the biliary tract or its complications such as peritonitis from a perforation of the gallbladder or an intestinal obstruction due to a gallstone There are those of us who feel that these are not infrequent occurrences but many of these patients have been treated in homes and custodial institutions where the diagnosis is not established and postmortem examinations are not compulsory Only routine postmortem examinations will establish the true situation

The aged patient who has biliary calculi is a potential candidate for any complication of gallstones and biliary tract disease Those associated with obstruction and spreading infection may develop with less pronounced manifestations than they do in younger individuals until the situation is nearly irretrievable As age increases and there is impairment of function of many organs and systems the margin of reserve so important in tolerating an increased demand becomes less and less It is the authors policy to evaluate these patients with care and if they believe that they can carry them safely through operation they recommend it In discussion with the patient they present the facts as completely as possible emphasizing that there is risk in either event

ACUTE CHOLECYSTITIS FOLLOWING UNRELATED SURGERY

In discussing biliary tract conditions requiring operation one should keep in mind the possibility of acute cholecystitis developing after surgery directed at some other or

gan or system The authors have repeatedly observed its occurrence in the early post operative period of patients undergoing operative treatment for unrelated disease It is prone to occur in aged patients especially males The unusual features are the high incidence of noncalculous gallbladders and the developmental relationship to the resumption of oral food after fasting The operation and the condition for which it was performed if there is no associated acute systemic disease are important only so far as they involve a period of fasting

The authors are interested in ways and means of attempting to prevent acute cholecystitis following the surgical treatment of unrelated disease for this may be a serious complication particularly in older patients For those individuals known to have cholelithiasis surgical therapy soon after the diagnosis has been established and at an early age when the morbidity and mortality are minimal provides the best method of interrupting biliary tract disease and obviating acute cholecystitis following unrelated operations The fulfillment of such a concept is of course impractical for many patients The next best approach then includes prophylactic measures directed at preventing the accumulation of large amounts of concentrated bile in the gallbladder and then a sudden and vigorous attempt to empty itself Prolonged periods of fasting should be avoided whenever possible Early mobilization after operation aids in the reestablishment of normal intestinal function Drugs that retard bile flow from the gallbladder to the duodenum should be used with understanding and caution Associated acute systemic disease and infection should be vigorously combatted The resumption of oral food after an operation should be begun with small amounts low in fat and cholesterol For example a coddled egg so frequently given to a postoperative patient is often the offending agent

Cholecystectomy is the treatment of choice though cholecystostomy may be indicated as a temporizing procedure to be followed by definitive surgery

CARCINOMA OF THE BILIARY TRACT

Any discussion of biliary tract disease should consider carcinoma Malignant and nonmalignant disease have been considered separately because the surgical treatment of the two are quite different Furthermore the treatment of malignant disease of the biliary tract is so ineffectual that it does not merit comparison with that directed at calcareous and inflammatory conditions In the management of patients 65 and over with biliary tract disease the possible presence of cancer must always be kept in mind It is estimated that slightly more than 10 per cent of patients in this age group demonstrated to have biliary tract disease also have carcinoma The majority but not all also have biliary calculi Within the period of 25 years 1932 to 1957 the authors operated upon 505 patients for nonmalignant disease of the biliary tract and 57 with cancer Thirty six patients had carcinoma of the gallbladder The records are explicit that calculi were present in 31 of the 36 or 88 per cent and that they may have been in some of the remaining 5 Fourteen were males and 22 females a somewhat higher incidence for carcinoma in males than for nonmalignant disease Most writers dealing with this subject have emphasized that carcinoma of the gallbladder occurs chiefly in gallbladders containing stones It has also been suggested from information available that the calculi have been present for a long time perhaps many years The authors observations tend to confirm those of others

The common association of cancer of the gallbladder with calcareous biliary tract disease renders differential diagnosis difficult Duration of symptoms caused by cancer would be expected to be relatively short From many in this elderly category one may elicit a history of gallbladder disease in early

Over the past 2 decades reports from several medical center hospitals have shown extremely low rates of morbidity of postoperative complications and mortality among patients under 50 years of age operated upon for chronic benign biliary tract disease Considerable numbers have been operated on consecutively without a single death The risk, as reported from these same clinics, is only slightly higher for those from 50 to 64, but considerably higher for those 65 and over The greatest risk in operation is clearly centered in the older group The authors lack figures to compare these results with those in patients with biliary tract disease who may have been incorrectly diagnosed, not treated surgically or both There can be little controversy over a policy that provides for the early surgical treatment of biliary tract disease soon after gallstones are formed and in the younger years of life

In those 65 and over there is an increasing trend toward early operation for those conditions where an acute and fulminating process has become established Acute obstructive cholecystitis and common duct obstruction are examples Likewise in chronic biliary tract disease with recurrent attacks of pain and indigestion the relief afforded by operation is largely considered by the medical profession to warrant the risk involved There is also an increasing realization that in this older age group chronic recurrent symptoms are not infrequently a forerunner of complications that require surgical correction The trend toward the surgical treatment for biliary tract disease in the aged is rapidly approaching that so well established for the younger aged group

There remains the problem of what constitutes the optimum management of the patient 65 and over who has been demonstrated to have gallstones by cholecystography or whose gallbladder is not visualized even by several attempts It is a fact that at postmortem examinations many individuals in the older age group have been found to have calculi within the gallbladder and the ductal system yet so far as can be determined, they had no symptoms of biliary tract disease Autopsy also reveals carcinoma of the gallbladder with gallstones where symptoms were present only in the terminal phase of the cancer Then there are all gradations of liver damage and biliary cirrhosis that seemingly have not caused symptoms Only occasional reports attribute death to an unsuspected primary disease of the biliary tract or its complications such as peritonitis from a perforation of the gallbladder or an intestinal obstruction due to a gallstone There are those of us who feel that these are not infrequent occurrences but many of these patients have been treated in homes and custodial institutions where the diagnosis is not established and postmortem examinations are not compulsory Only routine postmortem examinations will establish the true situation

The aged patient who has biliary calculi is a potential candidate for any complication of gallstones and biliary tract disease Those associated with obstruction and spreading infection may develop with less pronounced manifestations than they do in younger individuals until the situation is nearly irretrievable As age increases and there is impairment of function of many organs and systems the margin of reserve so important in tolerating an increased demand becomes less and less It is the authors policy to evaluate these patients with care and if they believe that they can carry them safely through operation they recommend it In discussion with the patient they present the facts as completely as possible emphasizing that there is risk in either event

ACUTE CHOLECYSTITIS FOLLOWING UNRELATED SURGERY

In discussing biliary tract conditions requiring operation one should keep in mind the possibility of acute cholecystitis developing after surgery directed at some other or

gan or system The authors have repeatedly observed its occurrence in the early post operative period of patients undergoing operative treatment for unrelated disease It is prone to occur in aged patients especially males The unusual features are the high incidence of noncalculous gallbladders and the developmental relationship to the resumption of oral food after fasting The operation and the condition for which it was performed if there is no associated acute systemic disease are important only so far as they involve a period of fasting

The authors are interested in ways and means of attempting to prevent acute cholecystitis following the surgical treatment of unrelated disease for this may be a serious complication particularly in older patients For those individuals known to have cholelithiasis surgical therapy soon after the diagnosis has been established and at an early age when the morbidity and mortality are minimal provides the best method of interrupting biliary tract disease and obviating acute cholecystitis following unrelated operations The fulfillment of such a concept is of course impractical for many patients The next best approach then includes prophylactic measures directed at preventing the accumulation of large amounts of concentrated bile in the gallbladder and then a sudden and vigorous attempt to empty itself Prolonged periods of fasting should be avoided whenever possible Early mobilization after operation aids in the reestablishment of normal intestinal function Drugs that retard bile flow from the gallbladder to the duodenum should be used with understanding and caution Associated acute systemic disease and infection should be vigorously combatted The resumption of oral food after an operation should be begun with small amounts low in fat and cholesterol For example a coddled egg so frequently given to a postoperative patient is often the offending agent

Cholecystectomy is the treatment of choice though cholecystostomy may be indicated as a temporizing procedure to be followed by definitive surgery

CARCINOMA OF THE BILIARY TRACT

Any discussion of biliary tract disease should consider carcinoma Malignant and nonmalignant disease have been considered separately because the surgical treatment of the two are quite different Furthermore the treatment of malignant disease of the biliary tract is so ineffectual that it does not merit comparison with that directed at calcareous and inflammatory conditions In the management of patients 65 and over with biliary tract disease the possible presence of cancer must always be kept in mind It is estimated that slightly more than 10 per cent of patients in this age group demonstrated to have biliary tract disease also have carcinoma The majority but not all also have biliary calculi Within the period of 25 years 1932 to 1957 the authors operated upon 505 patients for nonmalignant disease of the biliary tract and 57 with cancer Thirty six patients had carcinoma of the gallbladder The records are explicit that calculi were present in 31 of the 36 or 88 per cent and that they may have been in some of the remaining 5 Fourteen were males and 22 females a somewhat higher incidence for carcinoma in males than for nonmalignant disease Most writers dealing with this subject have emphasized that carcinoma of the gallbladder occurs chiefly in gallbladders containing stones It has also been suggested from information available that the calculi have been present for a long time perhaps many years The authors observations tend to confirm those of others

The common association of cancer of the gallbladder with calcareous biliary tract disease renders differential diagnosis difficult Duration of symptoms caused by cancer would be expected to be relatively short From many in this elderly category one may elicit a history of gallbladder disease in early

life and then a long period without symptoms followed by either an insidious development of digestive complaints or a sudden onset of pain jaundice and/or systemic reaction Perhaps the most frequent factor involved in biliary tract disease revealing itself in this age group is obstruction Obstruction due to calculi within the gallbladder may initiate an attack of acute cholecystitis that may either subside or run a rapidly fulminating course that terminates in perforation A calculus within the common duct may cause an obstructive jaundice accompanied or unaccompanied by pain Courvoisier s law is undependable in the older patients who have had calcareous disease of the biliary tract even with scarring of the gallbladder There may be loss of tone in the gallbladder wall associated with poor emptying so that over the years it may greatly enlarge and become distended when either the ampulla of the gallbladder cystic duct or common duct becomes obstructed Neoplasm may be the basic etiologic factor underlying the altered physiologic behavior of the biliary tract that results in calculi precipitating an obstruction as well as being the direct cause of occlusion At operation the surgeon should be thorough in his examination keeping in mind that about 1 of 10 patients 65 years and over will have carcinoma as a part of the biliary tract disease

Carcinoma of the extrahepatic ducts and the ampulla of Vater is less frequently associated with calculi There is a distinct preponderance among males the ratio approaching two males to one female in the authors experience Jaundice insidious in onset slight incomplete and intermittent or sudden and rapidly increasing is the general rule Pain is less frequently an outstanding manifestation than in calcareous disease but it is present in some degree in over half the patients Rarely is the diagnosis of carcinoma of the biliary tract established before operation unless there is evidence of gross liver metastasis The one laboratory result that the authors have found to be abnormal in all carcinomas of the bile ducts has been the alkaline phosphatase determination in all ages It has ranged from 11 0 Bodansky units to 99 4, with some tendency to be somewhat higher in the older age group

Surgical Procedures in Extrahepatic Biliary Tract Cancer

The surgical treatment of cancer of the gallbladder, bile ducts and ampulla of Vater has been most discouraging This pertains in particular to that of the gallbladder and bile ducts where it remains to be proven that surgical removal actually prolongs life Palliative procedures provide some relief of symptoms in certain instances Carcinoma of the ampulla of Vater is associated with a longer survival period following diagnosis whether or not local excision radical excision as provided by the Whipple procedure or a short circuiting procedure to relieve jaundice is performed Patients in the older age group may be prepared for and operated upon with a morbidity of complications and mortality rate quite comparable with those less than 65 years of age

Carcinoma of the Gallbladder

When a carcinoma of the gallbladder without evident metastasis is encountered at operation it is recommended that a radical cholecystectomy be performed This provides for the resection of the liver bed where the gallbladder is attached as well as of the peritoneum fat areolar tissue and lymphatics about the biliary ducts the hepatic artery and portal vein from the hilum of the liver down to the duodenum If omentum has been adherent to the gallbladder or any part of the extrahepatic ductal system it should be excised en bloc Following this procedure adequate drainage should be established because transection of the intrahepatic biliary ducts and opening into the vascular spaces invariably leads to considerable accumulation of bile and blood in the subhepatic area An occasional patient has lived for more than 2 years and the authors have observed one patient for 37 months

These periods of survival are believed to be somewhat greater than those among patients whose incisions have been closed without any attempt being made to remove the gall bladder after the diagnosis was established at operation In the authors own experience they have observed that patients who have had small metastatic nodules in the right or left lobe of the liver or both have rarely survived for a year usually they are dead within 4 to 6 months

Right hepatectomy for carcinoma of the liver and of the gallbladder has been success fully accomplished by several surgeons This has been advocated for cancer of the gall bladder without evidence of extension of the tumor and where this extension has been limited to the right lobe of the liver A suf ficient number of patients and their survival periods have not as yet been reported to justify a conclusion as to the value of hepatic lobectomy for cancer of the gallbladder Be cause the prognosis is at present so poor it is indeed reasonable to advocate this proce- dure Since the outlook for cancer of the gallbladder is so dismal and it is commonly agreed that over 90 per cent of gallbladders with cancer also contain stones early op eration for cholelithiasis specifically chole cystectomy appears justified regardless of whether or not there are any symptoms

BIBLIOGRAPHY

Baraen A L The Management of Respira tory Infection in the Older Patients with Bronchial Asthma and Pulmonary Emphy sema Geriatrics 8 423 1953

Charcot J Leçons sur les maladies du foie et des voies biliaires et des reins Paris 1877 Leçon 12 p 125

Cole W H Operability in the Young and Aged Ann Surg 138 145 1953

Coller F A and Dobbie R P Surgery in the Aged Geriatrics 9 303 1954

Cutler C W Jr Urgent Surgery in the Aged Ann Surg 126 763 1947

Cutter I S John Staugh Bobbs and Lithotomy of the Gallbladder Internat Abst Surg 47 409 1928

Dam H The Antihemorrhagic Vitamin of the Chick Occurrence and Chemical Nature Nature London 135 652 1935

Eliason E L Pylephlebitis and Liver Abscess Following Appendicitis Surg Gynec Obst 42 510 1926

Erdmann J F Malignancy of the Gallbladder Ann Surg 101 1139 1935

Fisher H C and White H Biliary Tract Surgery in the Aged A M A Arch Surg 63 536 1951

Fromer J L Surgical Risk of the Elderly Asthmatic S Clin North America June 627 1954

Gilchrist R K Postoperative Decompression of the Stomach and Jejunum by Gastrostomy *J A M A 152 232 1953*

Glenn F The Early Surgical Treatment of Acute Cholecystitis Am J Surg 40 186 *1938*

Glenn F The Importance of Technique in Cholecystectomy Surg Gynec & Obst 101 201 1955

Glenn F Surgery in the Aged Bull New York Acad Med 32 559 1956

Glenn F Gallstones without Clinical Symp- toms (editorial) Ann Surg 145 143 1957

Glenn F and Hays D M The Age Factor in the Mortality Rate of Patients Undergoing Surgery of the Biliary Tract Surg Gynec & Obst 100 11 1955

Glenn F and Hill M R Jr Extrahepatic Biliary tract Cancer Cancer 8 1218 1955

Glenn F and Mannix H Biliary En teric Fistula Surg Gynec & Obst 105 693 *1957*

Glenn F and Wantz G E Acute Cholecys titis Following the Surgical Treatment of Unrelated Disease Surg Gynec & Obst 102 145 1956

Johnson G Azar H A and Glenn F In farction and Multiple Abscesses of the Liver Following Biliary Tract Surgery A Case Re port Ann Surg 147 414 1958

Johnson G and Glenn F Multiple Liver Ab scesses Following Biliary Tract Surgery Ann Surg 140 227 1954

Kehr H *Gallstone Disease* Translated by W W Seymour P Blakiston s Sons and Com pany Philadelphia 1901

Langenbuch C Ein Fall von Exstirpation der Gallenblase wegen chronischer Cholelithiasis Heilung Berl klin Wchnschr 19 725 1883

Lloyd Davies O V and Angell J C Right Hepatic Lobectomy Brit Surg 45 113 1957
Milliken N T and Stryker H B Jr Suppurative Pylethrombophlebitis and Multiple Liver Abscesses Following Acute Appendicitis Report of a Case with Recovery New England J Med 244 52 1951
Pack G T Miller T R and Brasfield R D Total Right Hepatic Lobectomy for Cancer of the Gallbladder Ann Surg 142 6 1955
Roberts B Primary Carcinoma of the Gallbladder Surg Gynec & Obst 98 530 1954
Strohl E L and Diffenbaugh W G Biliary Tract Surgery in the Aged Patient Surg Gynec & Obst 97 467 1953
Warner E D Brinkhous K M and Smith H P A Quantitative Study on Blood Clotting Prothrombin Fluctuations under Experimental Conditions Am J Physiol 114 667 1935
Ziffren S E and Sheets R F Preparation of the Aged Patient Facing Emergency Surgery Geriatrics 8 629 1953

21

Liver Diseases

George E Wantz

Only a few diseases of the liver itself require surgical intervention and with the exception of neoplasms none predominate in the aged Thus the chief surgical concern is the relationship of the senescent liver to surgical convalescence and how it modifies the clinical manifestations and course of various diseases

THE LIVER IN OLD AGE

Certain anatomic and physiologic changes are generally accepted as occurring in the liver with normal aging and these provide a clearer understanding of diseases of the liver and surgery on that organ in elderly persons However there is no sharp demarcation between these normal changes in the liver and those which are pathologic Furthermore such changes are not constant since the rate of senescence of any of the bodily organs or systems varies with the individual

Both anatomic and physiologic senescent changes are recognized The weight of the liver gradually diminishes with aging though this is often masked by disease and malnutrition The average weight of the liver in the eighth decade is said to be 1 380 Gm in men and 1 180 Gm in women This progressive reduction in the weight of the liver parallels the reduction in lean body mass which occurs with aging and this in turn reflects the decline of metabolic rate with age and a decrease in total body water Little or no change occurs in the hepatic architecture though the reduced hepatic weight is recognizable by the diminished size of the liver cells and a consequent reduction in the width of the liver cords radiating from the central vein This atrophy of the liver in the aged person is not accompanied by increase in connective tissue framework which so commonly accompanied atrophy in other organs However if hepatic cellular atrophy is marked there may appear to be a relative increase in the fibrous stroma of the liver

Alterations in the cytoplasm and nuclei of the hepatic cell of the old liver are also recognizable The small size of the liver cells in old age is mostly due to diminished cytoplasm The accumulation and infiltration of lipochromes the wear and tear pigments occur in aged hepatic cells This pigment is also seen in other conditions characterized by reduced metabolic activity as in chronic malnutrition and debilitating chronic diseases Though there is some confusion as to the origin of these pigments their deposition gives rise to the common appellation of *brown atrophy* because it occurs in shrunken organ Binucleate cells are common but with age these gradually give way to polypoid cells and cells with hypertrophied and hypochromatic nuclei Mitoses are rarely seen These observations and the fact that hepatic regeneration lags in cellular production following partial hepatectomy indicates a reduced growth potential of the organ In addition phagocytic activity also decreases with age and parallels the size of the liver Despite these retrogressive

changes, evidence indicates that the hepatic cells probably become more resistant to hepatotoxins with age MacNider has demonstrated this fact conclusively in dogs

There is little concrete evidence that hepatic function as measured by the commonly employed clinical tests, seriously deteriorates with age This is not surprising, for the liver has enormous reserve function tremendous regenerative capacity, and a double blood supply These capacities would appear essential in view of the multiplicity of vital functions of the liver and its susceptibility to various toxins and nutritional deficiencies Nevertheless in 42 subjects between 65 and 86 years of age Rafsky and Newman demonstrated that 97 per cent had at least one abnormal common hepatic function test They reported an abnormality in the cephalin flocculation test in 76 per cent in the free cholesterol/cholesterol esters ratio in 71 per cent, in hippuric acid synthesis (oral) in 70 per cent in the thymol turbidity test in 21 per cent and in Bromsulphalein excretion in 20 per cent of their cases However since their study was uncontrolled and since hepatic function tests may be altered by non hepatic conditions their observations may be rightfully questioned

There is no evidence that there is a significant decrease in the volume or composition of bile in the aged The glycogen and vitamin C content of the liver however, generally decrease with age and alterations in the glucose tolerance curve commonly occur but whether the latter are the result of hepatic or pancreatic changes or of diminished intestinal absorption is not known The ability of the aging liver to handle cholesterol has been shown to be depressed yet this may not be entirely the result of altered hepatic function

The unique qualities of the liver have made it eminently suitable in the study of normal aging in experimental animals From the available evidence so far it appears that the aging liver is the organ least likely to mar senescence as well as surgical convalescence Yet this may prove a fallacious conclusion for perhaps the gerontologic techniques and methods are inadequate to evaluate accurately the aging liver or its effect on senescence

THE EVALUATION OF HEPATIC FUNCTION

Many tests have been devised to evaluate hepatic function but only a few have proven practical Hepatic function tests have their greatest value in (1) determining the cause of jaundice, (2) establishing the presence of suspected liver disease in the absence of jaundice and (3) following the course of liver disease No single test or combination of them will accurately provide the solution to these problems Moreover, they are not diagnostic nor are they a substitute for a careful history, physical examination and clinical judgment Finally, many of them may be abnormal in the presence of diseases unrelated to the liver Notable among such disorders are congestive heart failure malnutrition and renal thyroid and metabolic diseases Only those of greatest value in the aged are discussed below

Bilirubin Metabolism

Bilirubin is formed in the reticuloendothelial system as a by product of the breakdown of hemoglobin It is insoluble in water and is carried in solution in the blood and extravascular spaces by being linked to albumin It is soluble in alcohol and thereby is characterized as giving an *indirect van den Bergh reaction* It will not pass through the glomerular membrane (which explains the absence of bilirubinuria in hemolytic jaundice) but is excreted in the bile after it has been conjugated chiefly with glucuronic acid, by an enzymatic process in the liver The bilirubin glucuronides are soluble in water and give the *direct van den Bergh reaction* They are the chief forms of bilirubin found in the blood and urine of patients with hepatic or obstructive jaundice Slight but

persistent elevation of direct reacting bilirubin indicates presumptive evidence of liver disease

Bilirubin in the intestines is converted by bacteria to urobilinogen and then to urobilin the chief brown pigment of the stool Thus in complete obstructive jaundice clay colored stools are passed Some of the urobilinogen is absorbed by the intestines after which it is either metabolized or excreted unchanged in the bile or urine Thus provided the intestinal tract has not been sterilized with antimicrobial drugs urine urobilinogen is absent or greatly diminished in obstructive jaundice but is usually increased when there is hepatocellular disease The latter phenomenon presumably results from the inability of the liver to eliminate its portion of that which is reabsorbed by the intestine

Bromsulphalein Excretion

The excretion of Bromsulphalein in the bile by the liver is probably the most useful and sensitive test of hepatic function in the absence of jaundice Nearly all but not all of this dye is excreted by the liver and some is stored temporarily by the reticuloendothelial system The rate of excretion depends on functional integrity of the liver as well as the circulatory system Thus the clearance of Bromsulphalein from the serum may be abnormal in the absence of liver disease when there is shock and congestive heart failure In the presence of jaundice especially obstructive jaundice it is unreliable since it is a colorimetric test and because it is excreted via the biliary tract Abnormal retention sometimes occurs in the aged and frequently in the presence of a high fever

Alkaline Phosphatase

Alkaline phosphatase an enzyme produced by osteoblasts and by the liver is excreted in the bile It is commonly elevated in liver disease especially when there is obstructive jaundice in which event it parallels the degree of bilirubinemia Disproportionately and conspicuously elevated quantities are noted when there is prolonged incomplete obstructive jaundice as in biliary cirrhosis This occurs possibly because the proliferative small bile ducts may be the source of alkaline phosphatase The ability of the liver to excrete alkaline phosphatase returns more slowly than the ability to eliminate bilirubin and high serum levels may persist into the recovery phases of hepatitis and obstructive jaundice Elevated serum alkaline phosphatase commonly accompanies metastatic and primary hepatic malignancies hepatic abscesses and such nonhepatic diseases as sarcoidosis Paget s disease and bone tumors

Protein Metabolism

The liver is the chief if not sole source of albumin and a diminished serum albumin commonly accompanies liver disease despite an adequate protein intake Normally the liver synthesizes about 18 Gm (and more if necessary) of albumin a day but in chronic liver disease albumin production may be less than 8 to 9 Gm a day If there is an abnormal drain upon the albumin pool as may occur in ascites after paracentesis in hemorrhage in malnutrition or during surgical convalescence excessively low serum levels may develop The serum globulins are typically elevated in liver disease especially the alpha beta and gamma fractions The reason for this hyperglobulinemia is not definitely known but it is probably related to the stimulation of the reticuloendothelial elements in the liver and elsewhere Thus an elevated serum globulin may occur in several other diseases such as multiple myeloma

Flocculation Tests

The cephalin flocculation and thymol turbidity are the most useful of the flocculation tests In parenchymal liver diseases and especially in hepatitis such tests become strongly abnormal early in their course A positive result depends not so much upon quantitative changes of the serum protein as

upon qualitative alterations in the albumin and globulin fractions themselves

Transaminase

The transaminases glutamic oxaloacetic transaminase (GOT) and glutamic pyruric transaminase (GPT), are enzymes which permit the transfer of the aminonitrogen of aspartic acid to glutaric acid and, thereby, synthesis of oxaloacetic and glutamic acid Rich quantities of these enzymes are found in the liver, heart, skeletal muscle kidney, and brain Death of the cells of any of these tissues increases the serum transaminase level Especially high quantities are found when there is acute necrosis occurring in previously normal liver and the highest serum levels are encountered in viral hepatitides and carbon tetrachloride intoxication High levels are also sometimes noted in both primary and secondary hepatic malignancy, yet only slight to moderate elevation is noted in cirrhosis Should the hepatic cells become exhausted of the transaminase normal or subnormal quantities may be encountered even when there is frank hepatic necrosis Only very rarely is a high serum transaminase level (over 500) encountered in extrahepatic obstructive jaundice Thus serum transaminase determinations are most useful in the diagnosis of viral hepatitis They may be particularly helpful to the surgeon in distinguishing this from extrahepatic obstructive jaundice The GOT exceeds the GPT in the liver and greater amounts of GOT are found in the serum when there is hepatic necrosis However GPT in the liver greatly exceeds the quantity in the muscle of the heart and skeleton Thus serum GPT rather than serum GOT determination may prove more selective in evaluating liver disease

The Prothrombin Time

The prothrombin time is a valuable aid in evaluating liver disease A deficiency of prothrombin accompanies hepatocellular disease because the liver is unable to manufacture it In obstructive jaundice a prolonged prothrombin time occurs because the fat soluble vitamin K is not absorbed in the acholic bowel Thus the administration of vitamin K while correcting a prothrombin deficiency in obstructed jaundice frequently fails to do so in parenchymal disease

The coagulation defect in patients with liver disease is complex, and correction of the prothrombin time may fail to alter an *existing hemorrhagic tendency Deficiencies* of the Christmas factor, factor V, and factor VII as well as of fibrinolysin are often involved

Fat Metabolism

Cholesterol, a steroid is chiefly synthesized by the liver The liver not only excretes it in the bile but also destroys any excess High serum cholesterol determinations regularly accompany obstructive jaundice resulting principally from an excessive hepatic cholesterol production rather than from mere retention Prolonged obstructive jaundice as in biliary cirrhosis may produce an extremely high serum cholesterol resulting in xanthomas In acute liver disease and cirrhosis normal or subnormal serum levels are encountered Cholesterol esterification also is diminished in both acute and chronic hepatocellular disease The determination of ratio of free cholesterol to cholesterol esters is more important than the total serum cholesterol quantity in the evaluation of such conditions It should be remembered that serum cholesterol values are commonly altered in such nonhepatic disorders as diabetes nephrosis, thyroid disease and malnutrition

JAUNDICE

Jaundice is the most common manifestation of liver disease When clinically recognizable, the serum bilirubin is usually between 1 5 to 3 0 mg per ml There is little difficulty in determining its cause in the vast majority of patients The principal decision is whether the jaundice results from obstruc

tive lesions of the extrahepatic biliary system which require surgical intervention or whether it is a manifestation of primary liver disease such as hepatitis or active cirrhosis It is often surprising how these two conditions may so closely mimic one another Generally the diagnoses of portal cirrhosis and acute viral hepatitis are easily made But the early recognition of biliary and intrahepatic obstructive jaundice whether viral or toxic may tax the surgeon s diagnostic acumen Although laboratory tests are most useful the clinical history physical examination and clinical judgment prove in the last analysis to be the greatest diagnostic aids That unrelieved extrahepatic obstructive jaundice leads inexorably to liver damage often permanent or of such a degree that postoperative convalescence is jeopardized is an established fact On the other hand minimally stressful operations in patients with hepatitis or hepatic decompensation may terminate fatally Thus better results will be realized if operative intervention is delayed several days or weeks until the correct diagnosis is established

Obstructive Jaundice

Extrahepatic obstructive jaundice occurs most commonly in the aged since its causes are chiefly age linked diseases Obstruction of the common duct by gallstones is encountered more often than chronic pancreatitis or carcinoma of the pancreas common bile duct or ampulla of Vater This is because of the high incidence of cholelithiasis in the elderly and because the longer this condition has existed the greater is the likelihood that choledocholithiasis and acute or chronic cholangitis will supervene Detailed discussions of their manifestations are found under their appropriate headings elsewhere in the text.

Intrahepatic obstructive jaundice (cholangiolitic hepatitis or cholangiolitis) may be extremely difficult to distinguish from extrahepatic obstructive jaundice This diagnostic problem becomes especially enigmatic

whe ... of ... not ... C ... dru ... arsen... zin... drug to ... du... com... hep... ma... tur... and ... it h... eosin... dic ... ab... for ... cirrho... that ... contin...
O ... the ... *viral* ... marily ... angio... tract... mately flocculr... lestero... shortly conditio... useful ... abatement... panies ... is there... Neverthe... the jau... obstruc... with ...
P... gardles... plorat... hepato...

...ith a characteristic

...hepatic coma is still ...t not always implies ...n appears following ...placed on the liver ...ntestinal hemorrhage ...diuresis are likely to ...an elevated serum ...accompaniment of ...lue to this substance ...in its etiology Am... the intestines where ...ction of bacteria on ...of the products from ...io acids in the body ...onverted to urea by ...ild the liver be dis... ...l be shunted around ...or a portacaval ...quantities of it may ...tion However the ...ith either arterial ...is poor and other ...dls are important ...blood pH is alka... ...t ever occur in

...coma consists ...ic cause such ...orrecting col... ...ficiencies and ...function and ...level To re... ...n the gut oral ...ruptly curtailed ...ilized by 8 to 12 ...tered orally in di... ...d tap water enemas ...lly following gastro... ...Infusions of sodium ...the blood ammonia ...iptoms especially when ...a specific precipitating ...es (120 Gm) however ...sary ... A ... 25 to 50 ...d to ... ...ood am... ...pecific ... drugs ...not ... in the

are explored either early because of an erroneous diagnosis or late because the possibility of common duct obstruction cannot be eliminated

Hepatogenous Jaundice

Hepatogenous jaundice accompanies hepatic cellular injury and is encountered in the aged less frequently than obstructive jaundice Besides being a manifestation of *primary acute and chronic hepatic disease*, it may occur in a great many diverse systemic disorders such as burns, hyperthyroidism, infection and sepsis of any kind, poisons and trauma

Toxic hepatitis in its severest form is known as *acute yellow atrophy* Such inorganic and organic chemicals as carbon tetrachloride the insecticides the arsenicals cinchophen phosphorus the heavy metals, and bacterial and animal toxins may cause it The degree of hepatocellular injury and the rate of its manifestation naturally will vary widely In some instances jaundice hepatic decompensation, and even death may occur within hours after exposure to the noxious agent However, in other instances the first manifestations occurring years after intoxication may be those of chronic liver disease and cirrhosis Acute toxic hepatitis which occurs infrequently in the elderly is accompanied by early and strongly elevated serum transaminase and flocculation tests

Viral hepatitis occurs in two forms commonly designated as (1) *infectious hepatitis* and (2) *serum hepatitis* The clinical manifestations in each are essentially identical, the only differences being the incubation period, the absence of cross immunity, and the route of infestation

Infectious hepatitis occurs endemically sometimes epidemically and chiefly in children and young adults Its incubation period is 2 to 6 weeks Transmission of the virus is by the fecal oral route by contact with carriers or by contaminated food and water Inoculation of contaminated blood may also disseminate it

Serum hepatitis is transmitted only by transfusion or injection of plasma containing the virus, since the offending organism unlike that of infectious hepatitis is not found in the feces Only minute quantities of contaminated plasma are necessary to disseminate the virus, and inadequately sterilized syringes and needles, as well as insects may serve as vectors *The incubation period is 2 to 6 months* The transmission of serum hepatitis precludes its favoring any age group and it is as common in the elderly as in the young

The onset of fever and jaundice in infectious hepatitis is usually abrupt In serum hepatitis jaundice usually follows a short period of malaise weakness, anorexia, nausea and vomiting Shortly after the onset of jaundice there is often a period when acholic stools pass The disease varies in severity and only rarely do hepatic function tests fail to indicate definitely impaired function

Operations in patients with acute hepatitis are poorly tolerated and if erroneously performed regularly and often fatally accentuate the hepatitis In the past 15 years 973 patients with viral hepatitis have been treated at The New York Hospital-Cornell Medical Center Twenty five of these underwent exploration early in the course of their disease because they were diagnosed as cases of extrahepatic obstructive jaundice Five died but there were no deaths among the 3 who were over 65 years of age However convalescence was complicated and prolonged in the survivors Steroids administered in large doses have proved invaluable in treating severe viral hepatitis and it is perhaps significant that none of the patients who received such treatment died postoperatively

Chronic hepatitis or cirrhosis is the end result of chronic liver drainage regardless of etiology and in the aged is next in frequency only to benign and malignant extrahepatic biliary tract disease as a cause of jaundice Although there have been many classifications of cirrhosis only two principal types occur They are portal cirrhosis (Laennec s atrophic postnecrotic and alcoholic) and biliary cirrhosis Portal cir

volume although the measured plasma volume is usually elevated Generally the elevated plasma volume is the result of the increased portal volume The typical patient with ascites exhibits mild tachycardia hypotension contracted peripheral veins cool dry extremities and a drawn appearance all of these are manifestations attributable to a diminished effective plasma volume The mechanisms of salt and water retention and their interrelationships are not clearly understood Sodium retention appears to be largely due to an actual increased production of the salt retaining hormones of the adrenal cortex However diminished renal function through reduced glomerular filtration from decreased effective plasma volume may contribute to the sodium retention as well as to the failure of the diseased liver to detoxify aldosterone and other salt retaining hormones such as estrogen Water retention usually varies directly and precisely with the degree of retained sodium With more severe ascites a disproportional volume of water may be retained and is reflected in hyponatremia This water retention probably results from an increased production of the antidiuretic hormone (ADH) of the posterior pituitary when the demands by ascites for salt and water from the plasma are insufficiently met by the mechanism inducing maximal salt retention The chronic disease state may also contribute to the hyponatremia as well as t prolonged or excessive secr That salt and water sc ry homeostatic mecha e fact that the degree varies with the t sufficient to feed ites since edema d ascitic cirrhosis ite subsidence of or after

nsists mainly nd measures restriction fic treatment The degree of salt restriction varies with each patient A 2 to 3 Gm salt diet *is often sufficient, although it is usually nec-*essary to prescribe a diet containing less than 1 Gm of sodium chloride The mercurial compounds are the most effective diuretics They may not induce diuresis but *if they do, they should be continued* Chloride acidosis potentiates mercurial diuresis This may be induced by ammonium chloride in moderate doses but if neurologic signs occur calcium chloride administered orally may be substituted Intravenous salt poor human albumin only rarely induces diuresis, and enormous quantities are often necessary to correct any existing hypoalbuminuria Since it is expensive its effect is transient and it is accompanied by expansion of plasma volume and, consequently the likelihood of variceal hemorrhage its use is limited in the treatment of ascites

Unless abdominal distention hinders respiration or alimentation paracentesis should be avoided since hypoalbuminemia will be accelerated Occasionally the low salt syndrome may be induced by paracentesis This syndrome resulting from a diminished plasma volume and acute hyponatremia consists of weakness nausea vomiting apathy hypotension thready rapid pulse and an elevated blood urea nitrogen level It is more apt to occur if there has been prolonged salt restriction Its treatment re*quires not only the administration of iso-*tonic saline but usually albumin plasma or blood

Many operations have been devised for the relief of ascites The list includes the insertion of buttons or catheters to drain the fluid into the subcutaneous space bladder or veins omentopexy splenopexy hepatopexy ileoentectopy and bilateral adrenalectomy Most have proved completely unsatisfactory and none relieve the portal hypertension

Portal decompression however regularly relieves ascites Both side to-side and end to-side portacaval shunts are equally satisfactory Side to-side portacaval anastomoses *are mandatory if retrograde portal flow is*

author's experience The place of acidifying salts in lowering blood pH still awaits evaluation In patients who exhibit the chronic form, an adequate protein intake may be offset by balancing it with appropriate doses of oral neomycin

ASCITES

Ascites most commonly occurs as a complication of portal cirrhosis and sometimes in other types of cirrhosis and hepatic disease It usually implies hepatocellular failure and if it is not the result of peritoneal irritation or inflammation nearly always develops in the presence of portal hypertension Indeed an elevated venous hydrostatic pressure within the abdomen is the factor which causes the localization of ascites Nevertheless, there is considerable confusion concerning the importance of the role of portal hypertension in the production of ascites, because without associated hypoalbuminemia experimental animals and most patients with extrahepatic portal hypertension infrequently exhibit this condition clinically Greater stress has been attributed to hepatovenous hypertension as the predominant cause, since this regularly results in ascites even without hypoalbuminemia Common examples of this are congestive heart failure, constrictive pericarditis, and occlusion of the hepatic veins from either thrombosis (Budd Chiari syndrome) or tumor Hepatovenous hypertension not only results in a marked elevation of pressure in the hepatic sinusoids, the capillary bed of the liver, but also in portal hypertension In contrast to extrahepatic portal hypertension the capillary beds of all the abdominal viscera save those of the pelvis display an elevated hydrostatic pressure and may therefore contribute to the ascites by transuding fluid Moreover transudation is especially likely from the liver where the pressure in the sinusoids is much less than that in the capillaries draining into the portal vein because only a moderate increase in venous pressure is needed in this organ to upset the hydrostatic balance controlling fluid interchange to favor transudation However, whether there exists an increase in sinusoidal pressure in patients with cirrhosis is not definitely known, despite the fact that, in the cirrhotic liver, postsinusoidal obstruction has been clearly demonstrated

In cirrhosis there is also fibrous presinusoidal obstruction, and since sinusoidal pressure is *determined by the mean of the pressure* at opposite ends of the sinusoids it is possible that sinusoidal pressure may be normal in patients with cirrhosis Additional support for this contention is suggested by the fact that central veins and sinusoids in the cirrhotic liver are not dilated as they should be, were they subjected to elevated pressure

Thus the role of hepatovenous hypertension in the production of ascites in patients with cirrhosis is not clear The only fair conclusion is that in cirrhosis both presinusoidal and postsinusoidal obstruction are present and that in either instance portal hypertension develops Therefore ascitic fluid may arise independently or in various combinations from either the liver or splanchnic capillaries

Hypoalbuminemia commonly accompanies liver disease It influences ascites, since the rate of transudation of fluid depends on the difference between hydrostatic and oncotic pressure There is an inverse relation between the degree of portal hypertension and the degree of hypoalbuminemia in patients with ascitic cirrhosis, but because of the hydrostatic pressure there is no constant relation between ascites and the serum albumin levels Moreover if the tendency to ascites is severe the serum albumin level may have no effect on the ascites, presumably because of the increased hydrostatic pressure at play Thus, hypoalbuminemia is an important factor in the production of ascites only when the hydrostatic pressure in the liver or splanchnic capillaries is only mildly elevated

The continuous demand for fluid by ascites depletes the effective plasma volume Most patients with ascites especially those in whom the tendency to ascites is severe exhibit evidences of a depleted circulatory

volume although the measured plas— v— ume is usually elevated Generally — vated plasma volume is the result o — creased portal volume The typical — with ascites exhibits mild tachycardia — tension contracted peripheral veins — extremities, and a drawn appearance — these are manifestations attributab— diminished effective plasma volume — mechanisms of salt and water retention — their interrelationships are not clearly — stood Sodium retention appears to be — due to an actual increased production — salt retaining hormones of the adrena— tex However diminished renal func— through reduced glomerular filtration — decreased effective plasma volume ma— tribute to the sodium retention as well — the failure of the diseased liver to deto— aldosterone and other salt retaining — mones such as estrogen Water reten— *usually varies directly and precisely wit—* degree of retained sodium With more se— ascites a disproportional volume of wa— may be retained and is reflected in hypona— tremia This water retention probably resu— from an increased production of the a— diuretic hormone (ADH) of the poster— pituitary when the demands by ascites fo— salt and water from the plasma are insuff— ciently met by the mechanism induci— maximal salt retention The chronic disea— state may also contribute to the hyponatre— mia as well as to prolonged or excessiv— aldosterone secretion That salt and wat— retention are secondary homeostatic mecha— nisms is evident by the fact that the degree of salt and water retention varies with the severity of ascites it is just sufficient to feed the accumulation of ascites, since edema does not occur in advanced ascitic cirrhosis, and it ceases upon complete subsidence of the ascites either spontaneously or after portacaval shunt

Treatment of Ascites

The treatment of ascites consists mainly of salt restrict on diuretics and measures to improve hepatic function The restriction of salt is the most effective specific treat

—erbates necrosis and retards

of the short hepatic veins are —ly troublesome to secure At —ose these veins often result in —rations in the other small Such bleeding can be recog —*it occurs from behind the liver* —rta hepatis has been occluded —ually the only method whereby from this area can be controlled —nsive mobilization of the liver —ensive macerating injuries to a of the liver the best method of may be partial hepatectomy — the abdomen is indicated in all —uries Soft rubber Penrose drains —ised They should be used in suffi— —bers to provide drainage and brought out through a generous — the abdomen so that they may —orrectly

—SES OF THE LIVER

—amoebic and pyogenic abscesses oc— —liver The former are usually soli— —d often called *tropical abscesses* latter are multiple There is noth— —event their occurrence in the elderly incidence especially of amoebic ab —is very low in this age group Pyo— —cess of the liver have become rare development of antibiotics This —rtunate since they are associated —idding mortality

—*hepatic abscesses* develop sec— —eptic or suppurative foci else— body The common offending in order of incidence *Esch—* —ptococci and staphylococci — reach the liver via the —ary tract the hepatic ar— —mphatics by direct ex— —adjacent organ or through —*is pylephlebitis* with septic —ry to *or divertic* common —d focus Today —

marked The presence of enormous hepatic lymphatics may be a clue to such a situation which is definitely established if splanchnic portal pressure falls or intrahepatic portal pressure rises upon occlusion of the portal vein

In candidates for portal decompression, the ascites should be refractory The serum albumin should exceed 3 5 Gm per 100 ml, and hepatic function should be stable and good Naturally, portal hypertension is prerequisite

INJURIES OF THE LIVER

The liver is the most commonly injured abdominal organ and is second only to the brain in the frequency with which it is damaged as a result of blunt trauma This is not surprising if one considers the large size and relatively unprotected position of the liver Many hepatic injuries undoubtedly go unrecognized especially if they are not accompanied by hemorrhage or altered function When they are severe enough to present clinical manifestations they have a high mortality The mortality rate of hepatic injuries, once over 60 per cent has gradually decreased in the past 25 years as techniques have been evolved to control hemorrhage from the liver and as antibiotics have been developed to control infection The mortality in aged individuals however remains high Mikesky reported that the mortality of patients over 60 years of age is 38 per cent Though other factors, such as severity of the hepatic injury and the presence of associated injuries may affect the mortality, it is generally conceded that the high mortality of elderly patients results from their diminished capacity to withstand trauma

Pathogenesis

Traumatic liver injuries may be open or closed Open injuries usually result from penetrating or perforating stab injuries or high velocity missiles Automobile accidents falls, and blows commonly produce the closed and nonpenetrating hepatic injuries The degree of liver injury is dependent upon the severity of the violence Perhaps because of its more superficial location and large size, the right lobe is more commonly involved Rupture of the liver, which is frequently stellate may occur either subcapsularly or centrally Because they are delicate and abundant, the blood vessels and bile ducts are frequently torn resulting in necrosis Enlarged nonfibrotic livers (fatty liver) are more susceptible to injury However spontaneous rupture of the liver rarely if ever occurs Blunt injuries to the liver commonly result in widespread involvement and are, therefore much more serious than simple penetrating injuries

Hemorrhage is the principal cause of death in hepatic injuries Bile peritonitis hepatic necrosis, infection, and other injuries, however contribute to the high mortality Death from hemorrhage within the first few hours of injury is not uncommon Such bleeding is generally venous in nature and is the result of the fragile, thin walled vascular structure in the liver the lack of valves in these veins and their inability to collapse the massaging effect of diaphragmatic motion on the liver and the inability of blood mixed with bile to clot Central as well as subcapsular rupture of the liver frequently results in hemorrhage into the bile ducts A necrotic cavity in the liver develops blood and bile collect in it and, when the pressure rises to sufficiently high levels they may escape through the bile ducts

Clinical Features

The clinical features of liver injury result generally from immediate blood loss and shock Evidence of liver rupture may, however, be delayed There is abdominal pain which is intensified by respirations and which often radiates to the shoulder Besides the history of trauma there are often obvious evidences of external signs of injury in the region of the liver such as contusions and broken ribs Should these symptoms be delayed an enlarged and tender liver may be noted Sometimes concomitant injuries

may mask the damage in the liver Gastro intestinal hemorrhage, jaundice, and biliary colic suggest hemobilia which usually de velops several days after injury Jaundice as an immediate sequel to liver injury is rare and if present indicates rupture of the gall bladder or bile ducts Jaundice developing later is common and is a result of hepatic necrosis and infection Abnormal hepatic function tests usually occur if determinations are repeated frequently but because of the enormous reserve of the liver, do not always reflect the degree of trauma

Treatment

Operation is indicated in all patients with known or suspected liver injuries Treating liver injuries expectantly only results in a higher mortality rate By dividing the tri angular ligaments and the round ligament all surfaces of the liver are usually accessible through abdominal incisions Occasionally however, a thoracoabdominal approach is necessary particularly if the thorax is also involved The principal initial problem in liver injuries is the control of hemorrhage Hemorrhage may become worse when the abdomen is opened since this relieves the tamponading effects of intraabdominal pres sure Severe hepatic hemorrhage can be im mediately controlled by compression of the porta hepaticus Visible blood vessels and bile ducts should be individually ligated Mattress sutures in the liver are commonly necessary despite their devitalizing effect upon hepatic parenchyma Placement of these sutures is difficult as they frequently cut through the liver Autogenous omental grafts may be sutured over the raw surfaces and may help to control hemorrhage as well as to prevent the mattress sutures from cut ting

Sequestrated and necrotic liver should be excised Large cavities in the liver should be drained with soft rubber drains Packing the liver with gauze often results in many complications and recurrent hemorrhage following the removal of the pack is extraor dinarily common Furthermore the tight pack only exacerbates necrosis and retards healing

Lacerations of the short hepatic veins are often extremely troublesome to secure At tempts to expose these veins often result in additional lacerations in the other small hepatic veins Such bleeding can be recog- nized since it occurs from behind the liver after the porta hepatis has been occluded Packing is usually the only method whereby hemorrhage from this area can be controlled without extensive mobilization of the liver In very extensive macerating injuries to a single lobe of the liver the best method of treatment may be partial hepatectomy Drainage of the abdomen is indicated in all hepatic injuries Soft rubber Penrose drains should be used They should be used in suffi cient numbers to provide drainage and should be brought out through a generous incision in the abdomen so that they may function correctly

ABSCESSES OF THE LIVER

Both amoebic and pyogenic abscesses oc cur in the liver The former are usually soli- tary and often called *tropical abscesses* while the latter are multiple There is noth- ing to prevent their occurrence in the elderly yet the incidence especially of amoebic ab scesses is very low in this age group Pyo genic abscess of the liver have become rare since the development of antibiotics This fact is fortunate since they are associated with a forbidding mortality

Pyogenic hepatic abscesses develop sec- ondarily to septic or suppurative foci else where in the body The common offending organisms are in order of incidence *Esch erichia coli* streptococci and staphylococci Such organisms may reach the liver via the portal vein the biliary tract the hepatic ar- tery the hepatic lymphatics by direct ex- tension from an adjacent organ or through trauma Formerly *pylephlebitis* with septic emboli secondary to appendicitis or divertic ulitis was the common source and focus of the abscess Today however liver abscesses

are usually the result of *suppurative cholangitis* and biliary tract disease Abscesses secondary to uncomplicated hepatic trauma are actually uncommon, as are those associated with septicemia

The signs and symptoms of pyogenic liver abscess are those of severe sepsis Prostration high fever shaking chills marked leukocytosis, and an enlarged and tender liver regularly occur Jaundice is normally mild but is intense if there is cholangitis and extrahepatic biliary tract obstruction Hepatic functon studies are also regularly abnormal

Treatment consists of massive antimicrobial therapy and supportive measures Extrahepatic biliary tract obstruction must be relieved if it is present Surgical drainage is preferable and possible if the abscess is large Unfortunately pyogenic abscesses are usually multiple and small and often are not readily accessible

Amoebic abscesses occur secondary to intestinal infestation of *Endamoeba histolytica* While 5 per cent of those with intestinal amoebiasis develop amoebic hepatitis, not all develop abscesses Secondary pyogenic invasion is not too uncommon Amoebic abscesses normally develop insidiously and the signs and symptoms of sepsis are less intense than in pyogenic abscesses Amoebic abscesses are usually solitary and often large and may rupture into the pleural or peritoneal cavity Jaundice is often absent or at most minimal Amoebic abscesses are best treated with chloroquine rather than emetine and drainage by aspiration or open operation

CYSTS OF THE LIVER

Echinococcus or hydatid cysts of the liver are encountered so rarely in the elderly that they merit no discussion here but nonparasitic cysts usually congenital in origin are occasionally seen They may be single but are more often multiple Nearly half of the patients with polycystic disease of the liver have a similar process in the kidney Such patients are more apt to live into old age than those in whom the process is limited only to the kidneys Cystic disease is usually asymptomatic and unless there is portal hypertension or the growth becomes unusually large, requires no treatment

NEOPLASMS OF THE LIVER

The liver is a frequent site of neoplastic disease Unfortunately these growths are almost immune to therapeutic attack Benign hepatic tumors are usually curiosities and generally clinically unimportant In this country malignant neoplasms either primary or secondary are perhaps the only disease of the liver that actually show an increasing incidence with age

Primary Carcinoma of the Liver

Generally a distinction is made between the carcinomas arising from the liver cords which are known as *hepatocarcinomas* or *malignant hepatomas* and those arising from the epithelium of the bile ducts, which are called *malignant cholangiomas* or *cholangiocarcinoma* Such terminology is often confusing and not practical since in most primary liver carcinomas both cell types may be seen and the biologic characteristics of each are similar This however is in sharp contrast to those tumors which arise from the epithelium of the larger bile ducts and in this discussion these will be known as *bile duct carcinomas* whereas the others will simply be termed *primary hepatic carcinomas*

Incidence and Etiology

Primary carcinoma of the liver has a curious geographic distribution and incidence In this country it occurs rarely and is seen at only approximately 0 25 per cent of all autopsy examinations and constitutes about 1 5 per cent of all malignant neoplasms However in the tropics and in the Far East its incidence is high Among the Chinese it is responsible for 14 per cent of all cancers and among the South African Bantu for over 50 per cent It affects men in all ethnic

groups more commonly than women and in this country, occurs most frequently in the sixth and seventh decades in the tropics it predominates in the young

Primary hepatic carcinoma is more common than bile duct carcinoma Approximately four per cent of all patients with cirrhosis may be expected to develop carcinoma and nearly 80 per cent of primary carcinomas of the liver are associated with cirrhosis It is more commonly associated with hemochromatosis and postnecrotic cirrhosis where its incidence is double that which occurs with alcoholic cirrhosis

Although the precise cause of hepatic carcinomas is not known, there appears to be little doubt of the relationship to necrosis and regeneration and the cellular aberrations that may consequently result It is not necessary that the hepatic necrosis and repair be a generalized process because hepatomas may appear in areas of localized damage

Considerable research has been devoted to the experimental production of hepatic tumors and in these experiments the relationship of liver necrosis and regeneration is even more apparent than it is in human beings Nutritional deficiencies which in some experimental animals may alone result in the development of a primary hepatic carcinoma definitely increase their occurrence if combined with one of the carcinogenic substances The results in these animal experiments may not be directly applicable to liver carcinoma in man yet the relationship of hepatic necrosis and regeneration to nutritional deficiencies is clinically apparent

Pathology

Primary hepatic carcinomas occur most commonly in association with cirrhosis The higher incidence in men reflects their greater incidence of cirrhosis in this sex It may involve the liver massively or exhibit itself as a solitary tumor A nodular type sometimes occurs exhibiting multiple discrete nodules surrounding it stellately Occasionally there is diffuse infiltration of the liver by the tumor and a discrete mass is not noted The tumors are very vascular receive their blood supply almost solely from the hepatic artery and often undergo central necrosis Bile formation is common but generally is grossly unrecognized

Primary carcinoma of the liver typically invades small and large branches of the hepatic vein and the portal vein and sometimes it grows into the heart via the inferior vena cava

Bile duct carcinoma is more common in women and arises from the larger bile ducts within the liver It commonly exists as a single large mass which is gray homogeneous stimulating metastatic carcinoma covered with considerable fibrous tissue It is more closely related to cholelithiasis and choledocholithiasis rather than cirrhosis Bile duct obstruction severe liver damage and sometimes biliary cirrhosis accompany its appearance This tumor in contrast to the primary hepatic carcinoma does not invade the veins nor is it highly vascular and necrotic

Extrahepatic metastases usually limited to the regional lymph nodes commonly occur in both hepatocarcinomas and bile duct carcinomas

Multiple transitions from normal liver cells into very anaplastic tumor cells that may be seen in primary carcinoma of the liver suggest that such tumors arise multicentrically in the liver Thus it is likely that the hyperplasia of cirrhosis may develop into multiple carcinomas However bile duct carcinomas are uncommonly associated with cirrhosis and therefore probably arise from a single cell Whether unicellular or multicellular in origin rapid intrahepatic spread is nevertheless possible because of the rich vascularity of the liver

Clinical Manifestations

The clinical recognition of primary hepatic carcinoma is extraordinarily difficult and probably not more than a quarter are recognized ante mortem Even at laparotomy many are unrecognized This clinical inaccuracy probably results from its variable

and nonspecific clinical manifestations which mimic decompensated cirrhosis with which it is so commonly associated Thus the possibility of primary carcinoma of the liver must always be suspected in a patient with cirrhosis who, for no apparent reason suddenly and rapidly deteriorates especially when there is also ascites a painful tender, enlarged liver and severely impaired hepatic function Because rapid deterioration may also occur in any patient with cirrhosis it is not surprising that the diagnosis is often not made

Generally the manifestations of carcinoma of the liver are those of cirrhosis Cachexia anorexia anemia, mild leukocytosis, ascites, mild fever and right upper quadrant low grade pain are common Jaundice is frequently present, but this does not correlate with the extent of the carcinoma in the liver The liver is always enlarged and occasionally coarsely nodular when palpated In many patients hemorrhage from esophageal varices may be the first indication of hepatic carcinoma

Hepatic function tests reflect only the status of the underlying hepatic disease unless there is invasion of the major bile ducts or severe tumor necrosis Special studies such as portovenography and splenoportography, have, in the author's hands, been completely unsatisfactory in no instance have they demonstrated known hepatomas preoperatively Hepatic venographic studies however have provided more evidence of the presence of a tumor

Treatment

All forms of therapy have been unsuccessful X ray therapy has been used but without success Radioactive phosphorus is engulfed by the reticuloendothelial system of the liver but the use of this material has not altered the course of the disease Similarly there have been poor results from intraarterial or intraportal venous injection of various chemotherapeutic agents

Surgical excision is usually impossible because of the multiple and diffuse involvement of the liver Hepatectomy is perhaps still worth considering if the tumor is solitary Frequently, however it is even impossible to recognize its presence, especially if it is deep within the liver Moreover surgical intervention is often inadvisable, since advanced hepatic decompensation is usually also present

Prognosis

Prognosis of hepatic carcinoma is therefore, notoriously poor Almost all patients are dead within 6 months following the development of symptoms The prognosis of bile duct carcinoma may be slightly better Death may result from metastases, portal vein thrombosis hemorrhagic esophageal varices, hepatic decompensation intraperitoneal hemorrhage or superimposed infection Frank jaundice and ascites generally indicate the terminal phase of the disease

METASTATIC TUMORS IN THE LIVER

Except for regional lymph nodes, the liver is the most frequent site of metastatic carcinoma and this condition is therefore very common The cirrhotic liver however is rarely invaded by metastatic tumor Neoplasms which arise in the organs drained by the portal system are the most likely to metastasize to the liver Consequently carcinomas of the pancreas colon rectum stomach, esophagus, or gallbladder are the principal tumors which spread early to the liver Nearly as common as this source of metastases however, are carcinomas of the breast, lungs kidney, and pelvic organs In these instances the tumor reaches the liver through the diaphragmatic veins, by retrograde lymphatic extension and by direct contiguity Carcinoma of the gallbladder, common bile duct, and pancreas not only may extend to the liver by direct contiguity but also by intraductal and intramural choledochal migration Leukemia lymphoma, and myeloma are the sarcomas which commonly involve the liver

Once the tumor is established in the liver, it often luxuriates, becomes larger than the primary, and spreads elsewhere by invading the hepatic veins and inferior vena cava Frequently however metastatic tumors in the liver of the elderly grow for prolonged period Although it reaches the liver chiefly by the venous route metastatic tumor, like primary carcinoma and the regenerated nodules in cirrhosis receives its blood supply mainly from the hepatic artery Central necrosis of the tumor masses commonly accompanies growth which exceeds their blood supply, and hepatic arterial architecture may be greatly distorted Unless the tumor masses are very large it is uncommon to see distortion of the venous system

Clinical Manifestations

Metastatic carcinoma in the liver rarely produces clinical symptoms that suggest primary liver involvement until the patient is close to death The usual complaints are nonspecific and include anorexia weight loss cachexia abdominal distention mild fever malaise and anemia The chief finding is an enlarged nodular liver Mild jaundice owing to hepatocellular injury usually develops before death and is therefore an ominous prognostic sign Obstructive jaundice occurs less commonly and indicates neoplastic choledochal invasion Ascites as a result of peritoneal irritation and less frequently hepatic and portal vein obstruction occur in about half the patients Neoplastic cells are usually identifiable in the ascitic fluid which sometimes is bloody

Laboratory Findings

Hepatic function tests are nonspecific and unless there is advanced metastatic involvement are usually within normal limits Provided bony metastases are not also present the most consistent hepatic function test to be abnormal in metastatic disease of the liver is the alkaline phosphatase test Sometimes Bromsulphalein excretion is disproportionately delayed owing to the disturbed hepatic circulation Unfortunately the tests of hepatic function fail to be useful in the detection of early or minimal metastasis in the liver

Other diagnostic studies such as splenoportography hepatovenography and surveys of hepatic radioactivity after the administration of I^{131} tagged albumin have also proved unreliable in demonstrating any but the large and massive metastases The final resort is often exploratory laparotomy, especially if the primary site has not been determined

Treatment

The greater knowledge of the surgical anatomy of the liver and of the techniques to control hepatic hemorrhage has stimulated an aggressive surgical attack on metastatic tumors of the liver Such therapy is feasible and may prolong life if only one or two localized metatases are present However the majority of tumors are multiple and since partial hepatectomy has not significantly altered the deteriorating effects of metastatic carcinoma it seems unwise to perform it in the aged person Treatment by hormones administered to those patients with metastatic carcinoma from the prostate breast ovary or adrenal cortex are sometimes helpful Carcinoma of the prostate may respond to orchiectomy and to estrogen therapy whereas carcinoma of the breast may be inhibited by either androgens or estrogens by bilateral adrenalectomy and more recently by hypophysectomy Toxic substances such as nitrogen mustard and triethylene melamine have induced regression of the large liver and jaundice in patients with chronic leukemia or Hodgkin s disease X-ray therapy benefits only the radiosensitive neoplasm

PORTAL HYPERTENSION

Portal hypertension is a syndrome characterized by splenomegaly hypersplenism occasionally ascites alterations in intestinal flora episodic stupor hemorrhoids and esophagogastric varices Its surgical significance is that frequent always serious and

often fatal hemorrhage occurs from the esophagogastric varices Although portal hypertension may result from a variety of causes which impede the flow of portal blood, the chief offender is cirrhosis of the liver Since cirrhosis of the liver is largely a disease of advancing age, even though it may begin years earlier portal hypertension assumes special importance in any discussion of surgery in the aged

Normal Portal Physiology

The portal venous system which is valveless, consists of all the veins that drain the capillary beds of the stomach, intestine spleen, pancreas and gallbladder It ends in the sinusoids of the liver which are akin to capillaries, but which are larger with blood flow slower, pressure less, and the endothelial lining adherent to hepatic cells rather than to connective tissue elements Furthermore, the hepatic sinusoids interconnect a vein with a vein instead of an artery with a vein, as do capillaries The portal vein is formed by the splenic and the superior mesenteric vein The splenic vein receives blood from the spleen stomach and pancreas and via the inferior mesenteric vein from the left colon Blood in the superior mesenteric vein is from the stomach head of the pancreas, small intestine and right colon The blood in the portal vein from each of two principal tributaries is not always completely mixed before it is distributed to the liver thus should infection of organs drained by the superior mesenteric vein metastasize it tends to involve the right hepatic lobe

Hepatic blood flow varies from 1,000 to 2,000 cc per minute and averages 1 500 cc per minute About 80 per cent of this is portal blood The blood in the portal system is more highly saturated with oxygen than that in the systemic system, and although the former may supply about 50 per cent of the oxygen to the liver this source of oxygen is unreliable since it varies with intestinal requirements during digestion It can not replace that derived from the hepatic artery

Portal pressures are normally 8 to 20 cm of water but may vary depending on portal blood flow and blood volume, digestion, and respiration extremely high, though unsustained pressures may accompany coughing and straining A sustained portal pressure exceeding 25 cm of saline usually produces recognizable portal hypertension

Pathogenesis

In the vast majority of elderly patients portal hypertension is caused by cirrhosis of the liver and is the result of an intrahepatic block It is important to remember, however, that portal hypertension may result from extrahepatic venous obstructions, which are usually thought of as being prehepatic but may also be posthepatic Extrahepatic portal hypertension in the elderly is rarely a clinical problem

Prehepatic portal obstruction is encountered mostly in young adults and children and is frequently known as *Banti s syndrome* Thrombosis of the portal, splenic and superior mesenteric veins is the common finding Such thromboses may be the result of previous pylephlebitis or a low grade phlebitis but evidence of this in the patient s history is usually lacking Congenital anomalies of the portal vein alone or with thrombosis recanalization and cavernous transformation may also occur

Portal vein occlusion in the elderly usually results from neoplastic infiltration or compression The common neoplastic offenders usually arise in the kidney, pancreas stomach common bile duct or its major branches and duodenum but sometimes they may be metastatic Lymphoma and Hodgkin s disease may also occlude the portal vein In these circumstances portal hypertension is usually clinically unimportant as the primary disease is usually advanced and the patient often close to death About 5 per cent of the patients with cirrhosis also have an occluded portal vein owing to thrombosis hepatoma or both

Posthepatic portal hypertension may develop as part of a general increase in venous pressure, as in congestive heart failure Not

able examples of this are constrictive pericarditis tricuspid insufficiency, and pulmonary fibrosis Generally these conditions are easily recognized because of an elevated peripheral venous pressure and evidence of pulmonary and circulatory failure Nevertheless the erroneous diagnosis of cirrhosis of the liver with ascites is often made for constrictive pericarditis and thus this possibility must always be considered in evaluating any patient with portal hypertension and chronic ascites

The obstruction to the outflow of the liver may be localized to the hepatic veins owing to thrombophlebitis or neoplasm and this is known as the *Budd Chiari syndrome* If complete hepatic vein occlusion occurs suddenly death follows rapidly But with incomplete occlusion the patient may survive many years Thrombotic occlusion may be part of a migratory phlebitis or it may accompany polycythemia cirrhosis or some distant or generalized infection or inflammatory disease The occlusion in the hepatic veins may be localized at their origins or orifices Sometimes the process resolves with complete recovery Whereas portal pressure is rarely high enough to result in bleeding esophagogastric varices when it is associated with a generalized increase in venous pressure when it is associated with hepatic vein occlusion such hemorrhage is common Common to all these conditions however is the presence of ascites which is often difficult to control

The Budd Chiari syndrome is amenable to portal decompression If the occlusion of the hepatic outflow is complete or nearly so and the portal vein is the principal outflow of blood from the liver splenorenal or side to side portacaval anastomosis is mandatory Should the obstruction be minimal and the retrograde flow of blood through the portal vein no greater than that which occurs in cirrhosis end to-side portacaval shunt will be satisfactory since the portal hypertension will be relieved and flow of blood to the liver diminished

Intrahepatic portal obstruction is overwhelmingly the most common cause of portal hypertension both in the all age group and in the elderly All types of cirrhosis may lead to portal hypertension but the alcoholic and postnecrotic forms do so more frequently than the biliary Fatty liver and acute hepatitis may also be associated with portal hypertension, which then results from sinusoidal compression by hepatic cells swollen with fat or acute inflammation Such portal hypertension is transient and subsides unless the initial disease progresses to cirrhosis

The chief factors responsible for intrahepatic portal hypertension are (1) fibrosis of the portal bed, (2) vascular compression by regenerating hepatic nodules and (3) direct hepatic arterial communication with the portal venous system

Fibrosis beginning in the portal triads and then forming elsewhere is the principal early pathologic alteration in cirrhosis This fibrosis leads to a distorted and diminished portal bed of high resistance As the hepatic cells die internal Eck s fistulas develop because portal blood enters the persistent sinusoids and hepatic veins directly bypassing the hepatic parenchyma Enhancing and ensuring the mechanical obstruction resulting from portal fibrosis is the hepatic nodular regeneration Such regeneration begins in the fibrotic septa by the surviving hepatic cells and as these nodules enlarge they further distort and constrict the hepatic veins and also displace the central veins to the peripheral scar tissue The regenerated nodules derive the blood supply from the hepatic artery

Normally blood from the hepatic artery and portal vein are mixed and equilibrated in the peripheral aspects of the sinusoids Thus the high arterial pressure may slow portal blood flow and increase portal venous pressure especially if the vascular bed is distended The role played by such arteriovenous fistulas in the production of portal hypertension is still however hypothetical and debatable

The interrelation and the importance of each of the factors resulting in portal hypertension in cirrhosis are poorly understood

Doubtless all are important and portal hypertension may result from any one of the factors alone or in combination Although some belittle the importance of portal fibrosis as a mechanism producing portal obstruction examples are encountered in which this is the only demonstrable pathophysiologic alteration Obliteration of the small portal venous radicles without cirrhosis may be congenital or acquired The acquired type may, as in the case of extrahepatic block, follow pylephlebitis or other chronic intra abdominal disease such as ulcerative colitis Such livers are often small and though scar tissue in the portal triads often increases with time, nodular regeneration occurs very slowly

Cruveilhier-Baumgarten disease is an example of congenital hypoplastic liver with obliteration of portal venous radicles Because of this the umbilical vein fails to close at birth and serves to relieve portal hypertension Ultimately and sometimes not until old age this collateral channel becomes tortuous and highly resistant and frank portal hypertension with all its sequelae develops An enlarged spleen a small hyperplastic liver with good function and a caput Medusae with a venous hum are the characteristics of this disease The term *Cruveilhier-Baumgarten syndrome* is reserved for those instances of cirrhosis in which a caput Medusae and venous hum occur secondarily to recanalization of the umbilical vein or more often a paraumbilical vein

The Sequelae and Clinical Manifestations of Portal Hypertension

Collateral circulation develops in the gastrointestinal tract where glandular epithelium meets squamous epithelium Thus *esophagogastric varices* occur, since the gastric cardiac veins provide an outlet through the esophageal intercostal, diaphragmatic, and azygos veins and hemorrhoids occur since the superior hemorrhoid vein unites with the middle and inferior hemorrhoidal vein Another site of venous collateral circulation is located between the paraumbilical veins of the round ligament of the liver and the veins of the anterior abdominal wall Unless the inferior vena cava is obstructed dilated veins are easily recognizable in the abdominal wall radiating with their blood flow cephalad from the umbilicus Many collaterals also are present where the gastrointestinal tract and its appendages lie retroperitoneally These are known as *Retzius veins* whereas the venous collaterals between the liver and diaphragm are called *Sappey's accessory portal* The degree of development of each set of collaterals varies from patient to patient Not every person with portal hypertension develops clinically recognizable esophagastric varices Nevertheless, when they are present their size usually greatly exceeds other venous collaterals

Hemorrhage from esophagogastric varices is the most serious complication of portal hypertension Why these varices are likely to rupture has caused many lively and polemic discussions The factors which may lead to their rupture are (1) reflex peptic esophageal erosion (2) mechanical erosion by ingested food (3) a sustained increase in portal pressure All are no doubt important but the majority of evidence indicates that pressure is the most important For instance hemorrhage is most likely to occur at times of hepatic decompensation, when portal pressure regularly rises Most patients also note a peculiar feeling of abdominal fullness after eating for a few days prior to hemorrhage and this is presumably due to increased visceral congestion Greater elevated portal pressures are found at times of active hemorrhage which cease promptly upon portal decompression Overtransfusion often induces variceal ruptures Finally esophagitis is rarely if ever, seen in patients dying of variceal hemorrhage

Esophagogastric varices are easily demonstrated by barium examination of the esophagus and stomach Only rarely is it necessary to resort to esophagoscopy Splenoportogram performed by the rapid percutaneous injection of 40 ml of 70 per cent

Urokon into the splenic pulp has the advantage of demonstrating not only the collateral circulation but also the patency of the splenic and portal veins Portal venography is similarly useful at the time of operation Splenic pulp pressure correlates with portal pressure It may be measured percutaneously with a saline manometer Splenomanometric determinations may be diagnostically useful in determining the source of active gastrointestinal hemorrhage in patients with cirrhosis since they also may bleed from peptic ulcers Provided there is no shock pressures exceeding 35 cm of saline imply variceal rupture while pressures less than 25 cm indicate hemorrhage from another source

Doubtless altered gastrointestinal function owing to the chronic passive congestion of portal hypertension may occur but concrete evidence of this is lacking Nevertheless there arises an altered bacterial flora in the intestine of patients with portal hypertension and Gram negative bacilli may proliferate profusely in the ileum and jejunum This fact coupled with the congested intestines and the shunting of portal blood around the liver into the systemic circulation may be one of the reasons why there is a greater incidence of coliform septicemia in patients with portal hypertension It is the shunting of portal blood carrying ammonia and other noxious substances which are normally detoxified in the liver before entering the systemic circulation that gives rise to the *fetor hepaticus* and the *neuropsychiatric symptoms* in patients with portal hypertension or after portacaval shunt The role of portal hypertension in *ascites* has already been discussed Whether or not the bypassing of portal blood from the liver has any relation to the increased incidence of duodenal ulcer (10 per cent) in patients with cirrhosis has not been definitely established

Splenomegaly accompanies portal hypertension and the size of the spleen roughly parallels the degree and duration of portal hypertension Other factors which are not definitely known also play a role in producing splenic enlargement Splenomegaly occurs early and before the onset of portal obstruction in patients with biliary cirrhosis Also larger spleens are usually encountered in patients with postnecrotic and extrahepatic portal obstruction rather than in those with alcoholic cirrhosis Often hypersplenism accompanies the splenomegaly Thus anemia leukopenia and thrombocytopenia are frequently encountered Hypersplenism is rarely a serious problem and is usually relieved by portal decompression

Surgical Management of Portal Hypertension

Indications

Hemorrhage from esophagogastric varices is the chief indication for portal decompression since this is the dreaded complication of portal hypertension Hemorrhage, if not immediately fatal may lead to hepatic coma progressive hepatic failure or tracheobronchitis Moreover recurrent hemorrhage among the survivors is nearly inevitable Clinical evidence indicates that portal decompression does not significantly alter hepatic function in patients with cirrhosis and will prolong life by preventing recurrent hemorrhage The current mortality of an initial esophageal hemorrhage probably does not exceed 15 to 20 per cent which approximates the mortality of portal decompression Therefore the performance of prophylactic portacaval shunt seems unjustified Occasionally portal decompression is indicated in treating refractory ascites but only rarely in the aged for hypersplenism

Management of Bleeding Esophagogastric Varices

Unless the bleeding is really minimal hemorrhage should be checked by prompt pneumatic tamponade Sedation is rarely needed particularly in the elderly Blood loss and shock should be combated by fresh whole blood By daily tap water enemas and the instillation of powerful cathartics and neomycin into the stomach coma as a re-

sult of absorption of nitrogenous substances may be avoided After 48 hours the balloon tamponade may be deflated and in most instances this will control hemorrhage The *patient may then be prepared for elective* portal decompression Repeated or prolonged use of the esophageal balloon is inadvisable since it leads to hazardous complications such as esophageal or gastric perforation and aspiration pneumonia

Occasionally hemorrhage is not controlled by pneumatic tamponade, or there is early

TABLE 21 1 PORTAL HYPERTENSION IN THE AGED *

Series number	*Sex*	*Age yr*	*Diagnosis*	*Operative risk*	*Indication*	*Type of shunt*	*Follow-up*
54	Male	67	Alcoholic cirrhosis	Good	Hemorrhage	Elective end to-side portacaval	Survived 2 yr 4 mo death liver failure
61	Male	64	Postnecrotic cirrhosis	Good	Hemorrhage	Emergency end to-side portacaval	Survived 2 yr 3 mo death liver failure
65	Male	60	Alcoholic cirrhosis	Good	Uncontrollable hemorrhage	Emergency end to-side portacaval	Surviving and well 2 yr 7 mo
68	Male	72	Alcoholic cirrhosis	Very good	Hemorrhage	Elective end to-side portacaval	Surviving and well 2 yr 4 mo
72	Male	72	Alcoholic cirrhosis	Good	Hemorrhage	Elective end to-side portacaval	Died 8th post op day liver failure
78	Male	70	Alcoholic cirrhosis	Poor	Uncontrollable hemorrhage	Emergency end to-side portacaval	Died 13th post op day staphylococcal septicemia and peritonitis
84	Male	65	Alcoholic cirrhosis	Poor	Hemorrhage	Elective end to-side portacaval	Surviving 1 yr 4 mo
94	Male	61	Alcoholic cirrhosis	Good	Hemorrhage	Elective end to-side portacaval	Surviving 9 mo
98	Male	63	Cruveilhier Baumgarten disease	Good	Hemorrhage	Elective side-to-side portacaval	Surviving 9 mo
101	Female	66	Postnecrotic cirrhosis	Good	Hemorrhage	Elective side to-side portacaval	Surviving 4 mo
108	Male	69	Alcoholic cirrhosis	Good	Hemorrhage	Elective side-to-side portacaval	Surviving 3 mo
109	Male	61	Alcoholic cirrhosis	Good	Hemorrhage	Elective side-to-side portacaval	Died 3d post op day acute renal failure (? *transfusion* reaction)
S 15	Female	73	Alcoholic cirrhosis *thrombosed* portal vein	Poor	Uncontrollable hemorrhage	Emergency splenorenal	Died 7th post op day hemorrhage *thrombosis* of shunt hepatoma

* The New York Hospital-Cornell Medical Center

recurrent hemorrhage after its deflation Patients in whom this occurs have demonstrable uncontrollable hemorrhage and an emergency portacaval shunt may be lifesaving provided their hepatic reserve warrants it Other operations which are claimed to be of less magnitude such as ligation of the varices have not proved nearly as satisfactory in the control of variceal hemorrhage They merely delay the ultimate solution of the problem and subject the patient to two major operations rather than to one definitive procedure

Selection of Candidates

The mortality of portacaval shunt directly parallels the severity of the liver disease whether or not it is performed under elective or emergency condition Operation is never indicated in those with coma shock or frank hepatic failure However hepatic function in many can be improved by a period of rest and diet therapy thus lessening the operative risk Operative mortality is about ten to twenty per cent among the good risk patients Indeed it is negligible in those with minimal hepatic disease or mild cirrhosis In advanced cirrhosis however operative mortality may approach 50 per cent Satisfactory results are realized if the patients exhibit only mild to moderate wasting The serum albumin should be greater than 3 Gm per 100 ml and preferably greater than 3 5 Gm per 100 ml Similarly jaundice at most should be minimal (serum bilirubin less than 3 mg per 100 ml) Previous coma and refractory ascites increase operative mortality and operation is contraindicated in portal cirrhosis when there is severe hypoalbuminemia or intense jaundice

Type of Shunt

Portal compression is best accomplished by either end to side or side to side portacaval anastomoses which are equally satisfactory if correctly performed While the former is technically easier the latter is mandatory if marked retrograde portal serum flow occurs (see section on Ascites) The final portal pressure depends on the inferior vena cava pressure Failure to obtain a satisfactory fall in portal pressure indicates a poorly constructed shunt or unsuspected portal or vena caval occlusion If there is partial or complete portal vein thrombosis a splenorenal shunt is preferable They are however less satisfactory than the portacaval shunt Moreover, splenectomy is hardly ever justified since hypersplenism improves after portal decompression alone

Results

The results of portacaval shunt have been uniformly good In the author s experience late thrombosis of a portacaval anastomosis has never occurred the esophagogastric varices have promptly disappeared and recurrent hemorrhage has been prevented The incidence of neuropsychiatric symptoms appears to be no greater shortly after than before operation regardless of the type of shunt although as the liver disease advances they may appear or become worse The author s experience in the aged is summarized in Table 21-1

BIBLIOGRAPHY

Andrew W H Brown H M and Johnson J B Senile Changes in the Liver of Mouse and Man with Special Reference to the Similarity of Nuclear Alterations Am J Anat 72 199 1943

Boyd E Normal Variability in Weight of the Adult Human Liver and Spleen Arch Path 16 350 1933

Brauer R W Liver Function A Symposium on Approaches to Quantitative Description of Liver Function Publication No 4 American Institute of Biological Sciences Washington D C 1958

Child C G III *The Hepatic Circulation and Portal Hypertension* W B Saunders Company Philadelphia 1954

De Bakey M E and Ochsner A Collective Review Hepatic Amebiasis Internat Abstr Surg 92 209 1951

Feldman M The Liver and Biliary Tract in the Aged Geriatrics 10 370 1955

Ivy A C and Grossman M I in A I Lansing (ed) *Cowdry s Problems in Aging* 3d ed The Wilkins and Wilkins Company Baltimore 1952

Liebowitz H R *Bleeding Esophageal Varices Portal Hypertension* Charles C Thomas Publisher Springfield Ill 1959

MacNider W de B The Resistance to Chloroform of a Naturally Acquired Atypical Type of Liver Epithelium Occurring in Senile Animals J Pharmacol & Exper Therap 56 383 1936

Mikesky W E Howard J M and De Bakey, M E Injuries of the Liver in 300 Consecutive Patients Internat Abstr Surg 103 323 1956

Morgan Z R and Feldman M The Liver Biliary Tract and Pancreas in the Aged An Anatomic and Laboratory Evaluation J Am Geriatrics Soc 5 59 1957

Popper, Hans and Schaffner Fenton *Liver Structure and Function* McGraw Hill Book Company Inc New York 1957

Ochsner A De Bakey M and Murry S Pyogenic Abscess of the Liver Am J Surg 40 292 1938

Rafsky H and Newman B Further Studies on Liver Function Tests in the Aged Rev Gastroenterol 16 783 1949

Sparkman R S and Fogelman M J Wounds of the Liver Ann Surg 139 690 1954

Schiff L *Diseases of the Liver* J B Lippincott Company Philadelphia 1956

Steigmann F Godellas V and Canahuatic S M Jaundice in the Aged Diagnostic and Therapeutic Implications J Am Geriatrics Soc 3 1015 1955

Wantz, G E Ascites in Liver Disease Pathogenesis and Treatment S Clin North America 38 407, 1958

22

Renal Calculi and Tumors

Victor F Marshall

One of the most curious facts about the usual variety of idiopathic renal calculi is that they almost never form *for the first time* in a patient over 65 years of age The author has had only two examples in which the data were conclusive An important and common hazard of long term immobilization of younger patients is recognized generally to be renal calculosis but this is not true of patients over 65 even though osteoporosis is common Mineral and vitamin deficiencies or excesses scars and Randall s plaques periods of dehydration or infection and similar guesses in the tenor of wear and tear would all seem to be more common as life progresses but renal calculi are not Calculi formed mainly on the basis of obstruction infection are well known at all ages the most common example being a vesical stone Recognizable renal obstruction infection causing calculi has usually done so long before age 65 Hyperparathyroidism producing calculi has usually been recognized (or should have been) before 65 Gouty patients may continue to pass uric acid and urate calculi after 65 and of course patients with previous calculi and damaged urinary tracts often survive past 65 with continuing troubles Diagnosis and management of renal calculi are not significantly different from those in younger patients except that all programs in the aged are particularly tempered by the patient s expectancy and general resistance

While renal neoplasms are not rare they are uncommon after the age of 65 years Only about 10 per cent of the clinically detectable new growths of the kidney are found after this age Small benign adenomas in the kidney are common in routine autopsies but such tumors are very rarely clinically detectable The usual renal cancer of childhood Wilm s tumor or embryonal mixed tumor has been encountered in old persons just often enough to say that the occurrence is barely possible Five to ten per cent of clinical renal neoplasms are derived from the transitional epithelium and closely resemble vesical neoplasms in their behavior Eighty-five to ninety per cent however are of renal cell origin so called *hypernephromas* The methods of diagnosis and treatment are essentially the same in all adults regardless of age and accordingly the routine methods will not be discussed here The author has found the examination of urinary sediment for neoplastic cells by the Papanicolaou method to be highly useful in demonstrating those cancers arising from transitional epithelium but only rarely useful in cases of renal cell carcinoma Aortography has not been employed by the author as a diagnostic routine because of its hazards and because it has not often been necessary One of the commonest differential diagnoses needed is whether a mass in the kidney is a neoplasm or a simple cyst Many patients over 65 years of age are not good operative risks Since most simple renal cysts constitute little threat to life a reasonably sound diagnosis of cyst in this age group would avoid some hazardous operations The author has found nephrotomography as developed by Evans at

The New York Hospital–Cornell Medical Center, to be a great help in making this differentiation When this method has shown the lesion to be most probably a simple cyst the author has often aspirated the mass and had the fluid examined in Papanicolaou s laboratory He does not aspirate unless the evidence for cyst is good (or unless curative therapy is impossible or clearly not feasible) If the nephrotomographic appearance is typical of simple cyst and the fluid is clear and without neoplastic cells the author is usually sufficiently satisfied with the diagnosis to omit exploration of the poor or only fair-risk patient Cystadenocarcinomas, sometimes even with clear fluid do occur in the kidney but they are quite rare Cystic degeneration in renal-cell tumors does not often produce the nephrotomographic appearance of simple cyst, and this lesion almost never contains clear neoplastic cell–free fluid

When clinical evidence of metastases is lacking, the treatment of choice is nephrectomy If the neoplasm arises from the transitional epithelium complete ureterectomy is usually also essential and a node removal from the great vessels is in order except perhaps when the growth is of the very lowest grade If the cancer is of a solid, pearl forming squamous cell type all forms of therapy have promptly failed If the growth has been a histologically benign papilloma the survival rate has been excellent for example 13 consecutive patients all lived 5 years When the lesion has been of transitional cell type, periodic examinations especially cystoscopic have been essential because the recurrence of similar growths in the bladder has been very common

If the neoplasm is of the common renal cell variety the author has come to prefer radical to simple nephrectomy In a radical nephrectomy he removes the organ still inside Gerota s fascia and performs a lymph node dissection from the aortic bifurcation to the diaphragm Obviously a wide exposure is necessary for this The author has employed rib resections to improve exposure and he has tended more often to use a transpleural transdiaphragmatic approach when feasible Such an extensive operation calls for great cooperation by the anesthesiologist and the blood bank (see remarks about estimating operative blood loss in Chap 24) Radiation therapy has been of no demonstrable curative value in those cases in which the author has employed it

The results of treatment leave much to be desired The survival rates in 167 cases of renal cell carcinoma have been 57 per cent at 2 years and 35 per cent at 5 years The 10 year survival rate in 104 cases was only 18 per cent, and two of nine patients who survived 15 years have died with recurrences which appeared after 15 years! Perhaps the more radical nephrectomy now employed will improve this The fact that approximately half had recurrence within a mere 2 years suggests that many patients already had unrecognizable metastases at the time of treatment The fact that a moderate number did not show recurrence until 10 or more years had passed since nephrectomy suggests that the natural course of the disease is a major determining factor in all results regardless of present day treatment The histologic appearance of renal-cell cancers does provide useful prognostic information

BIBLIOGRAPHY

Foot N C Humphreys G A and Whitmore W F Renal Tumors Pathology and Prognosis in 295 Cases J Urol 66 190 1951

Humphreys G A Personal communication

Roland Samuel I and Marshall V F The Reliability of the Papanicolaou Technique When Cancer Cells Are Found in the Urine Surg Gynec & Obst 104 41 1957

Schmidlapp Carl J and Marshall V F The Diagnostic Value of Urinary Sediment A Review Based on the Papanicolaou Method New York J Med 50 56 1950

Southwood W F W and Marshall V F A Clinical Evaluation of Nephrotomography Brit J Urol 30 127 1958

23

Cancer of the Penis and Peyronie's Disease

Victor F Marshall

CANCER OF THE PENIS

Carcinoma of the penis is a medical curiosity before 40 years of age and is seen only occasionally in patients under 60 Age then is a definite factor in its development Persons circumcised in infancy or childhood only very rarely develop cancer of the penis in later life The earlier the circumcision is performed the greater the protection for example Jews who are circumcised in early infancy almost never have penile cancer in adulthood although the author has treated two while the disease is known among Moslems who are circumcised shortly before puberty It would seem then that routine circumcision of all male infants is indicated in order to prevent penile cancer if this were a common cancer in this country if the disease were one of youth and early manhood and if treatment were less effective than it is this procedure might be almost mandatory However one of the highest figures on incidence in this country is 0 9 per 100 000 men while a commonly used figure for carcinoma of the breast in women is 26 per 100 000 Yet bilateral simple mastectomy in infancy has not been advocated to prevent mammary cancer[1] Circumcision in infancy is not an absolutely benign and never a fatal procedure (a figure of 0 18 per cent mortality was reported from England and Wales in 1949) Considering the enormous number of routine circumcisions required to prevent a few penile cancers in later life the effort becomes at least an impractical one *for the sole purpose* of preventing this disease in our country In some parts of the world India and China for example this cancer is very much more common It is highly probable that consistent cleanliness is also an excellent preventive Proposals have been made that the incidence of two common cancers that of the cervix and of the prostate would also be greatly reduced by routine circumcision If this could be conclusively shown the argument in favor of routine circumcision to prevent cancer would be tremendously strengthened but the data are only suggestive Circumcision for traditional religious and perhaps merely cosmetic reasons is usually justified by the intangible gains at the very low risks and of course circumcision is often indicated in the treatment of existing disorders such as chronic balanitis and phimosis Incidentally a long prepuce with adherence to the glans is normal during the first year or two of life and does not constitute phimosis

Scars and leukoplakia on and about the glans meatus and frenulum are possibly slightly precancerous long standing chronic balanitis probably is Erythroplasia of Queyrat (Fig 23 1) although rare is definitely precancerous and accordingly should be clearly excised This presents as a red shiny



Fig 23 1 Precancerous erythroplasia of Queyrat

persistent spot usually near the corona and biopsy demonstrates its nature

Diagnosis of penile carcinoma is based upon biopsy of a sore that does not heal In the presence of a severe phimosis a dor sal slit in the prepuce may be necessary to expose the lesion Syphilitic chancre is be coming rare and modern antibiotics cause most other infectious ulcerations of the penis to heal completely and promptly Cancer of the penis is seldom painful but the dis-charges from secondary infection are often irritative as well as malodorous Obstruc-tion to urination is rare because of the characteristic slough This lack of pain and urinary difficulty often permits amazing pro crastination Sometimes half or more of the penis may be lost before the patient seeks medical attention Growth seems more rapid in the youngest patients but there is notable variation at all ages Metastases occur first to the inguinal lymph nodes but it is impres-sive how long many carcinomas appear to remain localized to the penis and just a few glands (Fig 23 2) Obviously a careful pal pation of the inguinal and femoral regions is valuable in a search for metatases and a general evaluation of the patient

It is nearly always advisable to spend a few days in cleansing the local lesion to re duce infection Alternating hydrogen perox ide soaks sulfonamide powder applications and drying exposure to air is an effective program Radical excision with inguinal node dissection is undertaken occasionally when infection is minimal or absent when the lesion is sufficiently limited and when the local blood supply is adequate However when metastases have occurred it is pref erable to remove the primary lesion first and to attack the inguinal region at a second operation

The primary lesion is best treated by local excision with a wide margin and this nearly always requires at least a partial amputa tion (Fig 23 3) When the extent of the cancer permits the urethra and its corpus spongiosum can be divided 1 to 2 cm distal to the level of section of the corpora caver nosa The terminal urethra can then be di vided longitudinally for a short distance turned back, and sutured to the closed stump of the corpora The skin and urethral mu cosa are then carefully approximated In such a fashion stricture of the new meatus

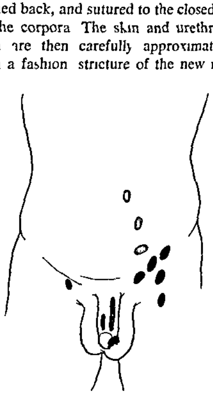


Fig 23 2 Spread of carcinoma of penis *(From V F Marshall Textbook of Urology Hoeber New York 1956 By permission of the pub lisher)*

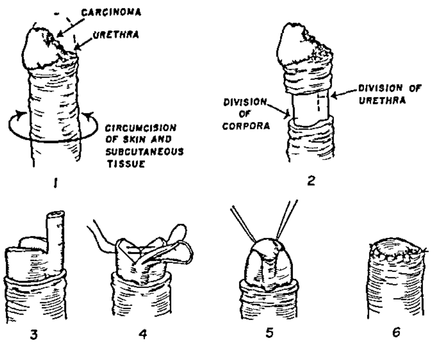


Fig 23 3 A technique for partial amputation of the penis

is nearly always avoided and healing is prompt The line of division should be at least 2 cm proximal to the gross extension of the neoplasm Microscopic examination of the tissues at the level of section can be helpful in determining the extent of the pro cedure If this requirement does not leave a penile stump long enough to permit flexible direction of the urinary stream total penec tomy with permanent perineal urethrostomy will be more satisfactory Obese patients thereby require total penectomy more fre quently than those who are slender In the formation of a perineal urethrostomy the author has nearly always divided the termi nus into a fish mouth which is sutured in spread-out manner and strictures have been uncommon A catheter is not inserted unless the patient already has or subsequently de velops difficulty in voiding

A diversity of opinion exists concerning the precise management of the inguinal nodes The incidence of metastases when the patient is first examined varies greatly in different reports from 20 to 70 per cent The incidence is likely to be highest among the ignorant or indigent who procrastinate extraordinarily Nevertheless a significant proportion in most studies have not had metastases Fundamental to this discussion is the fact that radical groin dissection is often followed by a long healing period which is particularly debilitating to many old patients If this did not occur bilateral radical groin dissection might become rou-tine Selective biopsy of a few nodes has been misleading because the most notice-able may be inflammatory while the can cerous can be simultaneously small A sim-ple groin dissection should provide an ade quate biopsy and still be followed by prompt healing In performing a simple dissection the author purposely leaves a little fat on the skin flaps dissects less widely does not go internal to the inguinal ligament and dis continues 6 to 7 cm below the junction of the saphenous with the femoral vein Sus picious nodes are examined by the frozen section technique and the procedure con verted to a radical dissection usually ipsi laterally if cancer is found Minute metas tases recognizable only in the permanent sec tions may actually be eradicated by simple groin dissection However if the patient is

considered to be *relatively robust*, an early radical iliofemoral inguinal node dissection is undertaken The general condition of the patient varies so *much that positive rules* cannot be propounded The feeble or elderly man with a relatively small lesion and without palpable inguinal *nodes is some*times best managed by amputation and follow up examination If metastases develop inguinal node dissection can be reasonably considered If the patient s condition is satisfactory amputation with bilateral simple groin dissection in the absence of evidence of metastases is recommended If cancer is *found in the inguinal nodes*, a radical node dissection on the involved side is the procedure of choice Even though cure may *not be obtained the prevention of a fungating* groin lesion with its danger of fatal hemorrhage is a worthy objective

Radical groin dissection is considered to include removal of all grossly recognizable fat from the anterior superior iliac spine to the midline of the symphysis transversely from 6 to 7 cm above the inguinal ligament *to clearly below the tip of the femoral tri*angle longitudinally, and from the inguinal ligament to shortly above the bifurcation of *the common iliac artery internally The au*thor prefers to carry out the internal dissection through an incision above the inguinal ligament rather than dividing that structure Mere division of the ligament provides only limited exposure *and is not nec*essary when the desired incision is made above The femoral canal with its node of Cloquet *under the* ligament is included The saphenous vein is removed between its junction with the femoral vein and the apex of the femoral triangle Care must be taken to transfix securely the saphenous vein flush *with the femoral vein using silk* since dangerous clots can form in a long stump The sartorius muscle is divided from its attachment to the iliac bone transposed with intact blood supply over the exposed femoral vessels and fixed with *catgut sutures* in this new position (Fig 23 4) This maneuver not only fills potential dead space but also provides effective *protection for the femoral* vessels particularly should a severe slough occur The parts of the skin flaps which are now cyanotic can be counted as certain to slough, so they are excised The rather large *cutaneous defect* can be closed in several ways One satisfactory method has been to remove the ipsilateral testis and epididymis, *dividing the cord immediately* above these organs The viable cord can then be fixed to fill other dead space in the groin or thigh The scrotum is next incised *around its up*per margin, spread, and draped out across the defect Although the appearance afterward is certainly unusual this has been the most effective and most simple means of *coverage Bilateral application is* possible by partial division of the scrotum in the midline However bilateral use of the method *necessitates bilateral orchiectomy* unless the scrotum is quite large or the testes unusually small On most other occasions wide mobilization of viable flaps with rotations and relaxing incisions as required has been em*ployed Large skin grafts have been applied* a few times with at least partial success Small stab wounds containing small rubber *tissue drains are placed in several dependent* sites and approximations completed A pressure dressing is applied *and is usually per*mitted to remain undisturbed for 5 or 6 days Infections are common and *often* require *local therapy* Loculations of serum or lymph may be aspirated and compressed but if this is not successful at the first attempt a small stab drainage is often better than repeated aspirations The maintenance of nutrition *and morale is very important* in these old men if a prolonged period of healing is in the offing

With such a program approximately half the author s patients have survived 5 years *without clinical* evidence of cancer However *the author* has seen recurrences become evident after a 5 year interval *The older* patient with a small cancer and no clinically suspicious inguinal nodes has an even bet

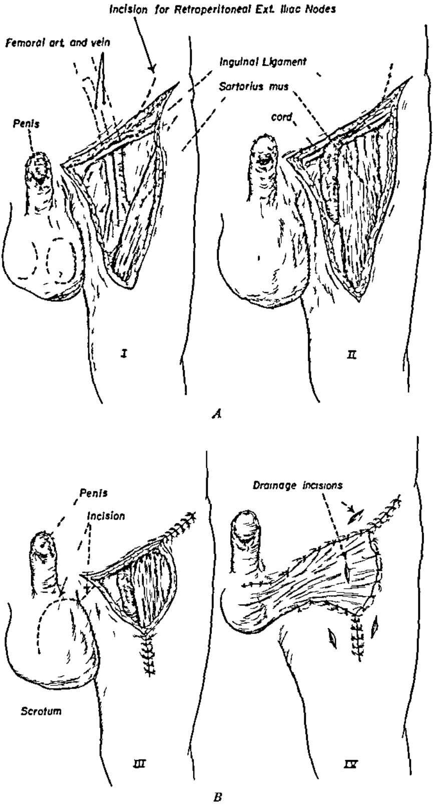


Fig 23-4 A Covering the femoral vessels at the end of radical groin dissection B Use of scrotum to fill cutaneous defect at end of radical groin dissection

ter prospect for survival, about 70 per cent which is only a little short of actuarial expectancy

PEYRONIE S DISEASE

Peyronie s disease or fibroplastic induration of the corpora cavernosa of the penis was once considered to be rare but minor degrees are actually fairly common The cause of the fibrous, leatherlike plaque or plaques on and in the dorsal aspect of the corpora is unknown Many patients with Peyronie s disease also have Dupuytren s palmar contracture The overlying skin and the corpus spongiosum are not involved but the fibrosis may be quite extensive in the corpora cavernosa The importance of the disorder lies in the deviation of the penis on erection and in the anxiety produced The condition is otherwise benign and self limited although extreme examples have been described in which erections have been actually painful and so deformed as to preclude intercourse Neoplasms in the corpora are very rare except as extensions or metastases from other usually quite obvious sites and so the differential diagnosis is not difficult Most patients with complaints from this fibrosis are less than 65 years of age but asymptomatic and previously unrecognized plaques are encountered during attentive examinations of older men Treatment consists principally in allaying anxiety particularly by emphasizing the benign nature and the self limited course (in fact, most fail to progress after they are first noted by the patient) Three- or four month courses of vitamin E (400 to 600 mg of alpha tocopherol daily) seem to cause some resolution or an early halt at least this treatment is safe, even if its efficacy has yet to be proved Forceful injections into the plaques of cortisone and/or hyaluronidase have been advocated, but the author has no significant experience except to point out that these injections can be quite painful Local irradiation has also had its advocates but the possibility of increasing the fibrosis seems too great Surgical excision has been extensively tried but the results have usually been more deformity and more anxiety If the deformity was so great that any change would be an improvement surgical excision could be worthy of trial The plaques will usually be found on exploration to be poorly defined and more diffuse than external palpation had suggested Such an operation has not been performed by the author since 1950

BIBLIOGRAPHY

Gairdner D The Fate of the Foreskin Brit M J 2 1433 1949

Marshall V F Typical Carcinoma of the Penis in a Male Circumcised in Infancy Cancer 6 1044 1953

Paquin A J Carcinoma of the Penis in a Man Circumcised in Infancy J Urol 74 626 1955

24

Cancer of the Prostate and Benign Prostatic Hypertrophy

Victor F Marshall

CANCER OF THE PROSTATE

Adenocarcinoma of the prostate is one of the commonest cancers found in men This neoplasm has been estimated to cause 15 000 to 20 000 deaths each year in this country When multiple sections were made of the prostates obtained at routine autopsies upon men past the age of 50 years histologic evidence of cancer was obtained in 15 to 20 per cent Also impressive is the fact that this incidence increases significantly with the age of the patients so studied Although clinically active prostatic cancer is not encountered so frequently the author was surprised to note that 20 per cent of the patients admitted to The New York Hospital–Cornell Medical Center because of prostatic disease have been diagnosed as having prostatic cancer Apparently the histologic changes considered indicative of cancer can be and often are present for at least a few years before the clinical disease is manifested What activates the latent small cancers is unknown Furthermore there is no measure of how much additional latency might be still present in any particular case There is no indication that the incidence in any particular age group will increase but the increasing ratio of aged persons in the general population will undoubtedly increase the actual numbers of patients with both the latent and clinical cancers

Clinical observations strongly suggest that prostatic adenocarcinomas grow more slowly in the older patients a small cancer detected in a man under 60 is more likely to prove fatal within a year or two than is a similar lesion in a patient of 70 or more years After the age of 80 progress is often so slow that many clinicians believe that treatment should await an overt threat With the additional consideration of these oldsters relatively small life expectancy (5 years or less) such procrastination is strongly justified Another suggestion that these cancers grow more slowly in the aged is derived from the author s impression that the older patients tend to have a longer history of developing troubles from prostatic cancer

Diagnosis

Cancer of the prostate and benign hypertrophy frequently coexist so that the presence of one in no way excludes the presence of the other Most men over the age of 65 years have at least some benign hypertrophy Only 15 per cent of these cancers appear to originate within the central benign hyperplasia while 85 per cent start in the peripheral portions (Fig 24-1) It is important to remember that the usual conservative prostatectomies performed for the relief of urinary obstruction caused by benign hypertrophy remove only the inner hypertrophy and leave the peripheral shell of

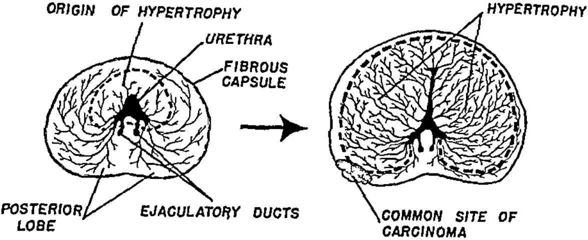


Fig 24 1 Sites of prostatic hypertrophy and cancer (cross section) (*From V F Marshall Textbook of Urology Hoeber New York* 1956 *By permission of the publisher*)

atrophic prostatic tissue in which approximately 85 per cent of the cancers originate Accordingly, a previous conservative prostatectomy provides very little prophylaxis The peripheral portion of the gland is particularly available to rectal palpation a procedure that is the most valuable and least hazardous single diagnostic step Hard areas, nodules and asymmetry are particularly suspicious of cancer

Benign hypertrophy alone produces a smooth, nearly symmetrical enlargement of even, elastic consistency but can also produce confusing nodules at times A very few prostatic cancers are soft but asymmetry and a variation in consistency are usually detectable even here The common firm cancer often extends into the seminal vesicles and may often be detected as a hard, nodular induration there As the true fibromuscular capsule of the prostate is invaded the gland tends to become fixed (Fig 24 2) Prostatic calculi large enough to be palpable occur with just sufficient frequency to demand consideration when the gland is palpably abnormal Sometimes a cluster of calculi can actually be felt to grit together, and radiographic examination will usually show their presence At least a few calcific shadows are very common in the prostates of men past 60 years of age so that the mere detection of calcification within the gland should not be taken to exclude the presence of cancer Tuberculosis of the prostate is becoming rare with the effective and prompt treatments now generally being administered and so this lesion is no longer important in differential diagnosis in this country, except obviously, in a patient with other indications of the disease An unusual and peculiar acute granulomatous prostatitis can produce a gland which has the typical feel of carcinoma but in these cases the history is usually one of an acute infectious onset and biopsy demonstrates the true nature of the condition

In spite of these and other important diagnostic considerations a palpable peculiarity of the prostate can seldom be established positively as cancerous without a biopsy Until dreadful carcinomatosis is present with its usually accompanying historical palpatory radiographic and chemical features biopsy is the only certain means of establishing the presence of prostatic cancer Papanicolaou examination of the urine after prostatic massage or better the examination of expressed prostatic fluid only occasionally reveals cancer cells and certainly this method is of very little value in excluding the presence of cancer in the prostate Aspiration biopsy through the perineum is like the Papanicolaou method reliable only when cancer is demonstrated Mechanical considerations sharply limit the reliability of

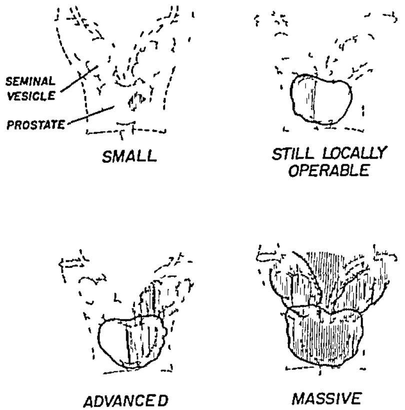


Fig 24-2 Rectal palpation of the prostate in four cases of carcinoma Light outlines normal shaded areas hard and nodular (*From V F Marshall Textbook of Urology Hoeber New York 1956 By permission of the publisher*)

aspiration biopsy when the cancer is small and the usefulness of the method is further reduced if the operator and his pathologist are inexperienced If the neoplasm is large however aspiration biopsy is often successful in obtaining proper selection and adequate amounts of tissue Although apparently a rare occurrence cancer cells have been implanted along the tract of an aspiration biopsy of the prostate Transurethral instrumental biopsy is of course reliable when cancer is demonstrated but small and even moderately large cancers which are located peripherally can readily be missed The author prefers open perineal biopsy when the nature of the prostatic peculiarity demands definition Training and experience are necessary but in proper hands the procedure has been demonstrated to be brief safe and highly reliable It has been the author s usual practice to obtain tissue for a frozen section and then to proceed to therapeutic measures at the same operative session according to the diagnosis The author has not employed transrectal biopsy as the other approaches have been sufficient and preferable in principle

When circumstances demand that biopsy be delayed the physician may employ two diagnostic tests of moderate but frequently illusory value The first is based on the concept that a cancer should continue to progress locally to such an extent that the development could be detected by rectal palpation Benign lesions might be expected to regress remain stationary or at least give clearer signs of their noncancerous character In reality many cancers remain palpably unchanged for months and occasionally even years Furthermore noncancerous lesions may palpably increase The second diagnostic test is based on the fact that about 75 per cent of prostatic cancers regress under the influence of estrogenic hormones Although

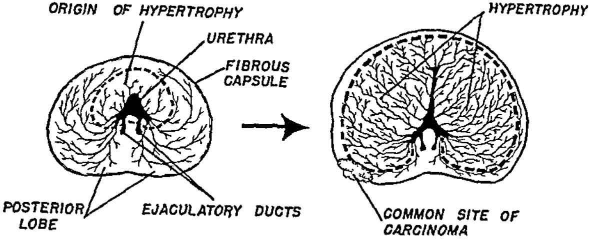


Fig 24 1 Sites of prostatic hypertrophy and cancer (cross section) (*From V F Marshall Textbook of Urology Hoeber New York 1956 By permission of the publisher*)

atrophic prostatic tissue in which approximately 85 per cent of the cancers originate Accordingly a previous conservative prostatectomy provides very little prophylaxis The peripheral portion of the gland is particularly available to rectal palpation a procedure that is the most valuable and least *hazardous single diagnostic step Hard areas* nodules and asymmetry are particularly suspicious of cancer

Benign hypertrophy alone produces a smooth nearly symmetrical enlargement of even elastic consistency but can also produce confusing nodules at times A very few prostatic cancers are soft but asymmetry and a variation in consistency are usually detectable even here The common firm cancer often extends into the seminal vesicles and may often be detected as a hard nodular induration there As the true fibromuscular capsule of the prostate is invaded the gland tends to become fixed (Fig 24-2) Prostatic calculi large enough to be palpable occur with just sufficient frequency to demand consideration when the gland is palpably abnormal Sometimes a cluster of calculi can actually be felt to grit together and radiographic examination will usually show their presence At least a few calcific shadows are very common in the prostates of men past 60 years of age so that the mere detection of calcification within the gland should not be taken to exclude the presence of cancer Tuberculosis of the prostate is becoming rare with the effective and prompt treatments now generally being administered and so this lesion is no longer important in differential diagnosis in this country except obviously, in a patient with other indications of the *disease An unusual and peculiar acute* granulomatous prostatitis can produce a gland which has the typical feel of carcinoma but in these cases the history is usually one of an acute infectious onset and biopsy demonstrates the true nature of the condition

In spite of these and other important diagnostic considerations a palpable peculiarity of the prostate can seldom be established positively as cancerous without a biopsy Until dreadful carcinomatosis is present with its usually accompanying historical palpatory radiographic and chemical features biopsy is the only certain means of establishing the presence of prostatic cancer Papanicolaou examination of the urine after prostatic massage or better, the examination of expressed prostatic fluid only occasionally reveals cancer cells and certainly this method is of very little value in excluding the presence of cancer in the prostate Aspiration biopsy through the perineum is like the Papanicolaou method reliable only when cancer is demonstrated Mechanical considerations sharply *limit the reliability of*

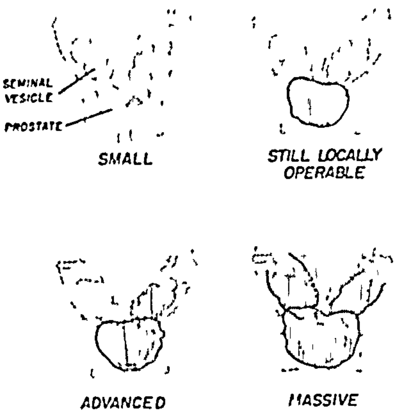


Fig. 24 2. Rectal palpation of the prostate in four cases of carcinoma. Light outlines normal; shaded areas hard and nodular. (*From V. F. Marshall: Textbook of Urology. Hoeber, New York, 1956. By permission of the publisher.*)

aspiration biopsy when the cancer is small and the usefulness of the method is further reduced if the operator and his pathologist are inexperienced. If the neoplasm is large, however, aspiration biopsy is often successful in obtaining proper selection and adequate amounts of tissue. Although apparently a rare occurrence, cancer cells have been implanted along the tract of an aspiration biopsy of the prostate. Transurethral instrumental biopsy is, of course, reliable when cancer is demonstrated, but small and even moderately large cancers which are located peripherally can readily be missed. The author prefers open perineal biopsy when the nature of the prostatic peculiarity demands definition. Training and experience are necessary, but in proper hands the procedure has been demonstrated to be brief, safe, and highly reliable. It has been the author's usual practice to obtain tissue for a frozen section and then to proceed to therapeutic measures at the same operative session according to the diagnosis. The author has not employed transrectal biopsy, as the other approaches have been sufficient and preferable in principle.

When circumstances demand that biopsy be delayed, the physician may employ two diagnostic tests of moderate but frequently illusory value. The first is based on the concept that a cancer should continue to progress locally to such an extent that the development could be detected by rectal palpation. Benign lesions might be expected to regress, remain stationary, or at least give clearer signs of their noncancerous character. In reality many cancers remain palpably unchanged for months and occasionally even years. Furthermore, noncancerous lesions may palpably increase. The second diagnostic test is based on the fact that about 75 per cent of prostatic cancers regress under the influence of estrogenic hormones. Although

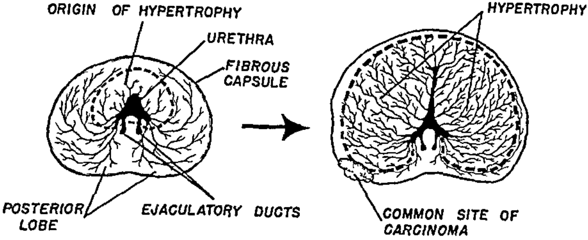


Fig 24 1 Sites of prostatic hypertrophy and cancer (cross section) (*From V F Marshall Textbook of Urology Hoeber New York* 1956 *By permission of the publisher*)

atrophic prostatic tissue in which approximately 85 per cent of the cancers originate Accordingly, a previous conservative prostatectomy provides very little prophylaxis The peripheral portion of the gland is particularly available to rectal palpation a procedure that is the most valuable and least hazardous single diagnostic step Hard areas nodules, and asymmetry are particularly suspicious of cancer

Benign hypertrophy alone produces a smooth nearly symmetrical enlargement of even elastic consistency but can also produce confusing nodules at times A very few prostatic cancers are soft but asymmetry and a variation in consistency are usually detectable even here The common firm cancer often extends into the seminal vesicles and may often be detected as a hard nodular induration there As the true fibromuscular capsule of the prostate is invaded the gland tends to become fixed (Fig 24 2) Prostatic calculi large enough to be palpable occur with just sufficient frequency to demand consideration when the gland is palpably abnormal Sometimes a cluster of calculi can actually be felt to grit together and radiographic examination will usually show their presence At least a few calcific shadows are very common in the prostates of men past 60 years of age so that the mere detection of calcification within the gland should not be taken to exclude the presence of cancer Tuberculosis of the prostate is becoming rare with the effective and prompt treatments now generally being administered and so this lesion is no longer important in differential diagnosis in this country, except obviously, in a patient with other indications of the disease An unusual and peculiar acute granulomatous prostatitis can produce a gland which has the typical feel of carcinoma but in these cases the history is usually one of an acute infectious onset and biopsy demonstrates the true nature of the condition

In spite of these and other important diagnostic considerations a palpable peculiarity of the prostate can seldom be established positively as cancerous without a biopsy Until dreadful carcinomatosis is present with its usually accompanying historical palpatory radiographic and chemical features biopsy is the only certain means of establishing the presence of prostatic cancer Papanicolaou examination of the urine after prostatic massage or better the examination of expressed prostatic fluid only occasionally reveals cancer cells and certainly this method is of very little value in excluding the presence of cancer in the prostate Aspiration biopsy through the perineum is like the Papanicolaou method reliable only when cancer is demonstrated Mechanical considerations sharply limit the reliability of

ance In fact prostatic carcinomas are the commonest cause These metastases to the lumbar spine and pelvis and to the pelvic lymph nodes account for the very frequent complaints of backache and sciatica A man of 65 years or more who develops backache and sciatica without readily evident cause should be considered to have metastases from prostatic cancer until proved otherwise The combination of backache osteoblastic areas in the lumbar spine or pelvis an elevated acid (and alkaline) phosphatase level in the serum and a palpably abnormal prostate constitute a highly reliable indication of prostatic carcinoma which has spread beyond curability This combination is an exception to the rule that biopsy is required to establish the diagnosis Unfortunately the combination is not rare

Treatment

Before beginning specific therapy considerations must be given to the general and common hazards which many of these patients face A co or preexisting obstruction at the vesical outlet is frequent and some may have renal damage with or without infection on this basis Certainly the aged victim is more likely to have nephrosclerosis and accordingly evaluation of renal function is in order In addition to the general remarks in earlier chapters concerning cardiovascular disorders in the aged an important item particularly pertaining to patients with prostatic cancer requires attention namely that administration of estrogens tends to cause fluid retention which may overtax a weakened cardiovascular system A fortunately uncommon hazard is a serious bleeding tendency caused by fibrinolytic enzymes derived from the cancer The author has encountered several examples of this bleeding tendency and in at least one death resulted The most practical means of detecting this blood dyscrasia is by gross comparison of the lysis of clotted venous blood from the patient with that from a normal control when the specimens are observed over 12 24 and 48 hours at 37 C

The only cure for prostatic cancer is complete excision (Fig 24-4) Unfortunately when they are first seen only 5 to 10 per cent of patients have the growth sufficiently localized to permit cure by excision In spite of this these men should not be denied their chance merely because they are a minority especially since they can be reasonably well identified While the occasional cancer of microscopic dimensions has been completely removed by a conservative prostatectomy the operator must be uncommonly sure if no further attempt at cure is made While the author has several examples of apparent cure under these circumstances he also has some distressing failures after what appeared at the time to be the same conditions Unless the patient is quite old or a very poor operative risk it has been the author's usual inclination to carry out a complete prostatectomy when an unsuspected small cancer has been disclosed by a conservative prostatectomy

The author prefers to perform curative complete prostatectomy and seminal vesiculectomy according to the method of Young although he has occasionally carried out the extirpation by a retropubic approach The principal advantage of the retropubic approach is that it permits inspection and biopsy of the pelvic lymph nodes although the author has not found it easy to explore and biopsy the prostate by this route Essentially the same amount of tissue is removed in each operation and the complications are not greatly different Some degree of unsatisfactory urinary control has been a permanent result of radical perineal prostatectomy in approximately 20 per cent of the author's patients with about half of this unfortunate group being severely incontinent The remaining 80 per cent have eventually regained quite satisfactory control although recovery has often required several months Meticulous attention to saving the muscular tissue on the prostatic apex seems to be reducing this incidence In addition to avoiding the membranous urethra the author attempts to peel back the tissues on the apex of the prostate

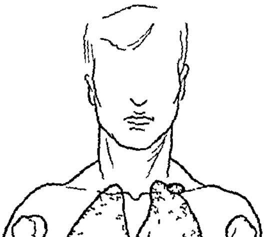


Fig 24 3 Sites of metastases from prostatic carcinoma Black most frequent shaded next frequent *(From V F Marshall Textbook of Urology Hoeber New York 1956 By permission of the publisher)*

this test is more reliable than the other a specific example may demonstrate how totally incorrect information often results from employing these methods Patient P K (N Y H No 681954) developed dysuria and a poor urinary stream The prostate was found to be hard nodular asymmetric and fixed According to several experienced examiners the gland was typical of locally advanced prostatic carcinoma Following 2 weeks of estrogenic therapy the symptoms were reduced and an impressive regression could be noted by palpation Castration and continued administration of estrogens against the supposed cancer seemed in order, but multiple liberal biopsies through a perineal exposure demonstrated only a granulomatous prostatitis!

When the cancer is beyond curability the steps to establish the diagnosis are rather simpler than when cure is a possibility The greater ease of obtaining tissue or cells from the prostate extensively involved by cancer has already been mentioned A biopsy of bone marrow or any suspicious lymph node may occasionally be helpful and definitive About 80 per cent of prostatic cancers secrete acid phosphatase When such cancers metastasize, this acid phosphatase is likely to be spilled into the blood stream, where the levels can be measured A reliable demonstration of such an elevation can be considered as almost pathognomonic of prostatic carcinoma with spread, because so few other disorders can produce this change Recent trauma to the gland (including vigorous massage) infarcts and hyperacute inflammation do occasionally produce a temporary elevation in the blood acid phosphatase The author has studied two examples of a rare disease agnogenic myeloid metaplasia in which there was an elevation of serum acid phosphatase but no prostatic cancer While a normal level of the acid phosphatase in the blood is of some value in excluding the presence of spread from prostatic cancer important exceptions are not rare for example, of 14 patients in whom preoperative tests including the acid phosphatase did not indicate metastases 6 were found to have cancer in the pelvic lymph nodes Metastases from prostatic adenocarcinomas tend to appear in the bones, particularly those of the lumbar spine and pelvis (Fig 24 3) This localization is largely determined by the venous pathways from the prostate Osteoblastic activity is usually stimulated by the metastases and causes irregular blotchy areas of increased density which can usually be noted on radiographs Such blotchy areas are of great diagnostic value, as prostatic cancers are among the few producing this appear

ance In fact prostatic carcinomas are the commonest cause These metastases to the lumbar spine and pelvis and to the pelvic lymph nodes account for the very frequent complaints of backache and sciatica A man of 65 years or more who develops backache and sciatica without readily evident cause should be considered to have metastases from prostatic cancer until proved otherwise The combination of backache osteoblastic areas in the lumbar spine or pelvis an elevated acid (and alkaline) phosphatase level in the serum and a palpably abnormal prostate constitute a highly reliable indication of prostatic carcinoma which has spread beyond curability This combination is an exception to the rule that biopsy is required to establish the diagnosis Unfortunately the combination is not rare

Treatment

Before beginning specific therapy considerations must be given to the general and common hazards which many of these patients face A co or preexisting obstruction at the vesical outlet is frequent and some may have renal damage with or without infection on this basis Certainly the aged victim is more likely to have nephrosclerosis and accordingly evaluation of renal function is in order In addition to the general remarks in earlier chapters concerning cardiovascular disorders in the aged an important item particularly pertaining to patients with prostatic cancer requires attention namely that administration of estrogens tends to cause fluid retention which may overtax a weakened cardiovascular system A fortunately uncommon hazard is a serious bleeding tendency caused by fibrinolytic enzymes derived from the cancer The author has encountered several examples of this bleeding tendency and in at least one death resulted The most practical means of detecting this blood dyscrasia is by gross comparison of the lysis of clotted venous blood from the patient with that from a normal control when the specimens are observed over 12 24 and 48 hours at 37°C

The only cure for prostatic cancer is complete excision (Fig 24 4) Unfortunately when they are first seen only 5 to 10 per cent of patients have the growth sufficiently localized to permit cure by excision In spite of this these men should not be denied their chance merely because they are a minority especially since they can be reasonably well identified While the occasional cancer of microscopic dimensions has been completely removed by a conservative prostatectomy, the operator must be uncommonly sure if no further attempt at cure is made While the author has several examples of apparent cure under these circumstances he also has some distressing failures after what appeared at the time to be the same conditions Unless the patient is quite old or a very poor operative risk it has been the author s usual inclination to carry out a complete prostatectomy when an unsuspected small cancer has been disclosed by a conservative prostatectomy

The author prefers to perform curative complete prostatectomy and seminal vesiculectomy according to the method of Young although he has occasionally carried out the extirpation by a retropubic approach The principal advantage of the retropubic approach is that it permits inspection and biopsy of the pelvic lymph nodes although the author has not found it easy to explore and biopsy the prostate by this route Essentially the same amount of tissue is removed in each operation and the complications are not greatly different Some degree of unsatisfactory urinary control has been a permanent result of radical perineal prostatectomy in approximately 20 per cent of the author s patients with about half of this unfortunate group being severely incontinent The remaining 80 per cent have eventually regained quite satisfactory control although recovery has often required several months Meticulous attention to saving the muscular tissue on the prostatic apex seems to be reducing this incidence In addition to avoiding the membranous urethra the author attempts to peel back the tissues on the apex of the prostate

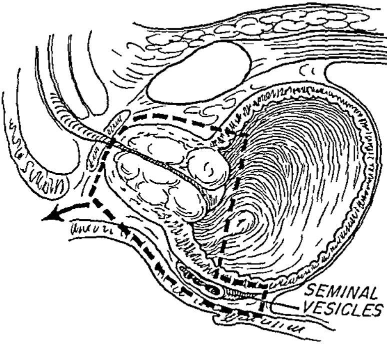


Fig 24 4 Radical prostatectomy (*From V F Marshall Textbook of Urology Hoeber New York 1956 By permission of the publisher*)

toward the membranous urethra thus saving what may be important sphincteric structures Obviously the patient whose cancer is in the apex of the prostate is not suitable for such maneuvers and is particularly likely to be incontinent following operation Operative injury to the rectum at the time of operation has been uncommon and rectourinary fistulas rare Because the possibility of rectal injury is always present, the author s usual practice is to prepare the bowel preoperatively as before an elective operation on the colon If injury does occur, a careful closure in layers has usually been successful, but the author has not hesitated to perform a temporary fecal diversion by transverse colostomy if the conditions appeared doubtful In the rare instance in which a rectourinary fistula has resulted a pull through type of operation upon the rectum with careful closure of the urinary end of the fistula has nearly always resulted in successful closure Complete prostatectomy invariably causes permanent sexual impotence and the author has encountered no exceptions to this Urethral stricture and urinary obstruction have been very rare following complete prostatectomy, in fact even less frequent than after conservative prostatectomy The mortality in the hospital following perineal prostatectomy conservative or radical, has always been gratifyingly low Fifteen years ago in one consecutive series of these patients, the mortality in the hospital was 1 5 per cent at a time when the rates after other types of prostatectomy were approximately twice that Since then both rates have declined but that of perineal prostatectomy has remained at least as low or lower than that of other types of prostatic operation The incidence of postprostatectomy hemorrhage has always been less after complete perineal removal largely because the bleeding vessels can nearly always be specifically identified and transfixed with ligatures of plain catgut

In regard to the control of cancer in these selected patients undergoing radical prostatectomy the author s results in comparable cases have been about 10 per cent less favorable than those reported by Jewett who reported 37 per cent of those whose cancers appeared clinically confined within the prostate itself as living without evidence of recurrence for 10 or more years after the op

eration The proper selection of candidates for radical prostatectomy can hardly be over emphasized Liberal selection may permit more operations but with smaller prospects of cure at the price of somewhat increased risks Jewett found that only 12 5 per cent of 48 patients survived 10 years when their cancers were judged by palpation to have extended into the fibrous capsule or into the seminal vesicles Of a consecutive series of 162 unselected patients in The New York Hospital in various stages of the disease with and without therapy 13 per cent survived 5 years While hope of cure is the principal reason for performing radical prostatectomy the fact that the operation is the nearest to a guarantee of permanent complete relief of urinary obstruction has been an additional mild encouragement to the author to perform the operation in somewhat borderline circumstances particularly in slight invasion of the fibrous capsule

Realizing the importance of proper selection and knowing that these cancers can metastasize early to the clinically silent pelvic lymph nodes Brice and the author have been making a study of these pelvic lymph nodes in patients considered to be curatively operable These patients have had normal chemical studies no radiographic evidence of metastases and at least no more than a bare suspicion of seminal vesicular or capsular invasion by palpation At the time of writing 24 such patients have had a diagnostic pelvic node dissection Seven of these were found to have cancer already in these nodes Obviously a cure in these 7 cases could not be obtained by Young s operation alone Several years ago in conjunction with Whitmore at the Memorial Center for Cancer and Allied Diseases a series of radical cystectomies with bilateral node dissections at least as high as the bifurcation of the aorta was begun on patients whose cancers locally extended beyond those justifying radical perineal prostatectomy yet whose other studies did not provide evidence of metastases Metastases were found in pelvic nodes in half of these and none with nodal metastases survived 5 years after the operation though all had castration in addition From the above experience it is the author s present opinion that the presence of metastases in the pelvic glands demonstrates incurability Pelvic node dissection adds significantly to the magnitude of the operation but it does appear to eliminate a significant number of predetermined failures to cure by radical prostatectomy An accurate correlation between the presence of nodal metastases and the size of the primary lesion is not available but a reasonable guess is that most patients with cancers occupying half or more of the gland have nodal metastases while most with primary cancers occupying less than 20 per cent of the gland do not

When cure by radical prostatectomy is attempted the author usually includes bilateral orchiectomy At least half the patients who underwent radical prostatectomy were not actually cured and castration does definitely reduce the activity of the great majority of these neoplasms It seems reasonable to hope that the slowing of a small perhaps unrecognizable volume of cancer might result in a longer clinical remission than that which follows from the retardation of a large volume Perhaps the patient who is going to have a recurrence will then not only have it after a longer course but will also have more consecutive asymptomatic days After all the removal of the testicles at that time adds very little risk and does not deprive the patient of anything more than psychological advantages since he will surely be both sterile and impotent from the complete prostatectomy While it is not possible to demonstrate beyond all doubt that the above advantages actually acrue the author s experience has provided no indications to the contrary

Palliation

When eradication of the cancer is not possible or an attempt at cure has failed there is still much worthwhile to offer Patients can be made more comfortable and have their lives lengthened The demonstration that

this common cancer can be retarded in 80 to 90 per cent of cases by varying the hormonal environment has been one of the greatest achievements in oncology and urology. It is the author's impression that castration has been more effective than any other single therapeutic modality. The major source of androgens is thus permanently removed by a generally safe and nondebilitating operation. The patient with prostatic cancer generally loses his potency and fertility under any course. The psychological trauma of castration appears minor indeed in comparison with the usual benefits. The administration of estrogens (stilbestrol and estradiol have been most used by the author) is also highly effective, but as a single modality there are certain specific disadvantages: therapy may readily be permitted to lapse, the tendency to fluid retention previously mentioned may place a significant burden on a barely compensating cardiovascular system, and enlargement of the breasts occasionally causes some psychological anxiety. There are theoretical and clinical reasons to believe that the simultaneous use of castration and estrogens is more effective than either modality alone and little clinical evidence to the contrary has appeared even after a wealth of experience. The author therefore strongly inclines to use both modalities promptly. The program of using one and saving the other, like a trump card, has not been clinically demonstrated to be more efficient, although there are capable urologists who favor such a program and who would therefore probably like to make such a demonstration. The author feels that simultaneous and early use of both deterrents is likely to provide the most continuous relief and may even provide slightly more relief in view of the smaller amount of cancer originally affected.

In an early series of the author's patients with advanced metastatic cancer, the complete clinical remissions averaged 11 months. This series included 10 to 15 per cent who had either no remission or such brief and incomplete remissions as to be of no practical consequence. Remissions for 3 years were not rarities, but complete relief for more than 5 years was something of a curiosity. Many of the remissions were dramatically prompt and complete. Evaluating the effect of hormonal control in cases of small and nonmetastatic cancers is very difficult not only because of the problems in establishing an accurate diagnosis of this situation but also and especially because of considerable variation in the natural course of the disease. The author has seen several small and originally operable cancers eventually progress even under hormonal therapy, and so he feels that a prostatic cancer sufficiently developed to permit diagnosis in a living patient should be considered an active and not a latent one. In other words, when the diagnosis can be made on a living patient, the physician can rarely rely upon the cancer being inactive and accordingly unworthy of any therapy.

If castration or estrogenic administration has been singly employed, the one not used should certainly be applied when the first remission begins to lapse. The author has not often been impressed with the secondary remissions thus attained, but the therapy is simple and significant secondary relief occurs just often enough thoroughly to justify the attempt. Aside from castration and estrogenic administration, other means to produce a remission are definitely much more uncertain than these two. In conjunction with the urological service at the Memorial Center for Cancer and Allied Diseases, extensive trials of bilateral adrenalectomy and open surgical hypophysectomy have been made. Although a definite benefit has accrued in some cases, a truly excellent clinical remission has been decidedly uncommon. Furthermore, these operations and the constant postoperative regulation they entail do not constitute minor therapy. Patients with poor renal function have not stood these procedures well, and the author feels even a greatly reduced but still compensated renal function to be a major contraindication to either adrenalectomy or hypophysectomy. The hypophysectomy has been the less risky

and perhaps actually the more effective of these two partly investigative procedures and accordingly the author has discontinued bilateral adrenalectomy His few experiences with reducing pituitary function by external irradiation have been generally inconclusive except to demonstrate considerable variability and usually at least a quite incomplete result The author has had little experience with transnasal hypophysectomy and/or the injection of radioactive materials into the sella in fact he has felt little need to labor in this direction since the neurological service has developed a technique which has proved reasonably safe and has been demonstrated to be highly efficient in eradicating pituitary function At times the administration of cortisone has seemed temporarily to improve the patient s general status Surprisingly the administration of testosterone to castrated and estrogenized patients occasionally and temporarily improved their sense of well being but this can be quite dangerous as a few patients have been made suddenly and drastically worse The author s very limited trial with the injection of radioactive gold into the prostate was not encouraging but the greater experience of the principal investigator suggests that this therapy may be worthy of consideration in some incurable patients

Other modalities not directed against the neoplastic process itself do have great clinical value in making the patient more comfortable Obviously analgesic and narcotic drugs have been much employed X ray radiation directed at a localized and painful metastasis has often alleviated a particular source of distress Cautious use of intrathecal alcohol has been worthwhile when the principal source of pain has been mediated through the lower parts of the cauda equina However nervous sequelae have occurred with significant frequency and so the author tends to reserve intrathecal alcohol until the circumstances are so bad that the risks and inconveniences of an indwelling catheter of weak leg function and of a lax anal sphincter are comparatively minor If the sources of pain are more diffuse a bilateral thoracic chordotomy may be considered for relief Although generally effective in relieving pain in the lower half of the body most candidates for chordotomy are in poor general condition for this rigorous operation and many already have painful thoracic metastases Finally the urinary tract itself often requires management by transurethral resection to relieve obstruction and by drugs to reduce infection Obviously good clinical judgment is necessary in obtaining the maximum palliative effect and these palliations can be manna from heaven to the patient

BENIGN PROSTATIC HYPERTROPHY

Benign hypertrophy or hyperplasia is so common in men that it might be considered normal rather than abnormal This type of prostatic enlargement is rare before the age of 45 but it is present in some degree in about three fourths of all men after 65 The cause is not precisely known but the hormonal changes of maturing and senility are certainly involved Castration in youth will generally prevent the hyperplasia in both humans and animals but produces little or no shrinkage once the enlargement is present Many of the pathologic features suggest actual neoplasia and the very common presence of arteriosclerosis has suggested that variations in vascularity may play a role in causation The rate of growth varies considerably among individuals even in the same patient decreases sharply in old age and often appears to halt completely The factors influencing these variable rates of growth are also unknown The appearance of clinical difficulties depends on the balance between the enlargement and the effectiveness of the urinary expulsive forces With increasing age the enlargement may not actually progress but the compensating forces may decrease thus producing the same effect as if the enlargement had continued There is little reason to believe that the incidence of benign prostatic hyperplasia is increasing but because of the growing proportion of

older individuals in our growing population the actual number of persons with this condition will certainly be greater in the years ahead Even now on many large general urologic services, about two thirds of all patients are being treated for obstructive disorders at the vesical outlet, of which about three fourths are caused by benign prostatic hypertrophy The corrective procedures have become definitely safer during recent years and with this the indications for correction have become less restrictive In other words earlier operations are being done and on a larger number of patients

Diagnosis

Diagnosis begins with an accurate history Chronologic age alone does not cause frequency, nocturia hesitancy dysuria or burning on urination Watching the patient void is often most informative While rectal palpation of the prostate is essential to accurate diagnosis the mere size of the gland does not indicate whether or not obstruction is present Some huge prostates produce little mechanical obstruction and compensation even then may be adequate On the other hand some small fibrous prostates cause severe obstruction with gross decompensation A large residual urine in the bladder tends to push the prostate down and make it seem much larger than it truly is and accordingly *palpation after a large residual has been removed* is worthwhile Prostatic hypertrophies are not treated *merely because of their volume* but because the mass and its configuration produce obstruction To go further the obstruction is the fundamental cause of the frequently associated infections With a slowly progressive obstruction the bladder is nearly always able to compensate for a time by working harder sometimes being assisted by the conscious use of the abdominal muscles If the bladder is unable to empty itself that is becomes decompensated a *residual will be present* immediately after voiding The measurement of this residual is *therefore not only an indication* of the degree of obstruction but also a demonstration that decompensation is present The residual may be determined by catheterizing the patient immediately after he has voided The instrumentation should be done cleanly gently, and with a soft catheter, because the procedure is at least mildly traumatic and is being performed in the presence of an existing pathologic condition The author s usual practice is to leave a small amount of mild antiseptic in the bladder (30 cc of 1 5,000 silver nitrate, for example) in the hope of controlling any newly introduced infection *Caution and reason must be employed by* the examiner while at the same time he *bears in mind* the probably great value of the information that he will obtain by the catheterization A bladder containing a residual of over 200 cc can usually be outlined by percussion and often palpated Residual urine can also be estimated at the time of intravenous pyelography by having the patient evacuate the bladder after it has been opacified by the contrast medium coming down from the kidney *This radiographic* technique is especially useful when catheterization is difficult or when delay or avoidance of the procedure is desirable The radiographic outline of the bladder may clearly indicate the presence of vesical hypertrophy trabeculation or even diverticula These changes in the bladder result from work hypertrophy and consequently are good indications that an obstruction is present These vesical abnormalities may be observed *through the cystoscope* but it is rare that cystoscopy is indicated in the early phases of *investigation* as it has all the disadvantages of catheterization with a relatively large and rigid tube On the other hand much valuable information can be obtained by the use of this instrument and unsuspected but important matters may thereby not be overlooked It is the author s practice to carry out a cystoscopic examination on all patients who are to undergo prostatectomy but this examination is frequently not carried out until immediately before the operation often as a preliminary stage in the operating room It is rarely possible to be certain that the

prostate is causing an obstruction by looking at it through an instrument, but the view of the bladder may often provide that evidence Of course routine urinalysis is in order but routine culturing is actually of only quite minor value Fundamentally prostatism is not so much a battle between the patient and some parasitic organisms as it is a struggle to overcome obstruction The modern wide spectrum antiseptic drugs are usually quite effective in temporarily suppressing the organism even in the face of major obstruction However true cure of infection usually requires the relief of the obstruction in fact the patient may succumb to the obstruction while the infection is suppressed or altogether absent If unusual organisms or combinations are suspected and there is reason to hurry Gram s stain of the urinary sediment will usually give the desired information at once Although this attitude against routine culturing is almost heretical today the author obtains such cultures in not over 10 per cent of the patients he treats for the common variety of prostatic obstruction he has not yet had reason to regret his position

The principal threat to life from prostatic obstruction is renal damage Evaluation of renal function is therefore essential to the complete diagnosis and hence to the planning of the therapeutic program An elevation of the blood urea nitrogen or nonprotein nitrogen level is usually an indication that renal function has already become decompensated but a normal figure does no more than show that decompensation has not yet occurred In other words a normal blood urea nitrogen provides no measure of the renal reserve If decompensation has occurred so that some degree of uremia is present a study of the status of the electrolytes is usually in order Among these the carbon dioxide combining power is particularly useful since the uremic patient without acidosis will stand much more than his acidotic counterpart Intravenous pyelography is one of the most valuable means of studying the condition of the kidneys Not only does this pyelography provide information concerning renal function but it also gives some indications of the worth of one kidney compared with the other Finally the architecture of the upper urinary tracts and often of the bladder is usually revealed The patient with hydronephrosis is obviously in a more precarious state than the one without such dilations and the patient with a good thickness of renal parenchyma generally has better prospects than the one with a greatly reduced renal parenchyma Older individuals are particularly likely to have nephrosclerosis as well as other renal disea es antedating or coexisting with the effects produced from the prostatic obstruction Intravenous pyelography will often demonstrate the renal architecture even in the presence of uremia if films are made at intervals of 4 6 8 and even 10 hours after the injection of the contrast medium The phenolsulfonphthalein output is also a useful measure of renal function in cases of urinary obstruction However if there is residual urine catheterization is necessary in order to obtain complete collections of the specimens to be examined for output a consideration also true concerning the urea clearance test When renal function is reduced obtaining a base line of information from which to note improvements is most valuable during the therapeutic program Even though the point has been stressed in earlier chapters a general evaluation of the whole patient can hardly be overemphasized Patients in these age groups usually have some degree of cardiovascular disorder and many are suffering from malnutrition At the present time more than half the deaths in the hospital following prostatectomy are the immediate result of cardiovascular disorders The syndrome known as *silent prostatism* merits particular attention because patients who suffer from it are usually in a very precarious condition which may not be immediately evident In these cases the patient s general condition appears to have deteriorated for no clear reason although mere senility is usually blamed On first review the complaints seem unrelated to the urinary tract anorexia constipation flatulence weakness weight loss

poor cerebration, etc A careful history will nearly always uncover some urinary complaints, particularly frequency of urination and bed wetting The physical examination will often find a distended bladder and a poor urinary stream The condition is actually an obstructive uremia which is partly cloaked by malnutrition arteriosclerosis, and most probably some degenerative sensory changes which have masked the symptoms directly from the urinary tract Obviously a complete and accurate evaluation of the whole patient and his urinary tract is essential to the intelligent and cautious planning of corrective therapy for patients having silent prostatism

Differential Diagnosis

In making the differential diagnosis of benign prostatic hypertrophy other not uncommon causes of obstruction between the bladder and the exterior must be considered (Fig 24-5) Fibrous contracture of the vesical outlet and median bar formation are very similar in their effects and are managed directly along the lines of prostatism caused by benign prostatic hypertrophy However contracture of the vesical outlet usually appears before the age of 65 and is usually preceded by some history of prostatic infection or trauma With contracture and bar formation the prostate is usually found to be small and fibrous on rectal examination and instrumentation usually conveys the impression of tightness and rigidity in the region of the prostate and vesical outlet (and the patients often void better temporarily following dilation) Urethral strictures may likewise cause prostatism but a significant history is usually present and the site of the obstruction is usually readily located in the urethra Carcinoma of the prostate is commonly associated with benign prostatic hypertrophy and the obstructive difficulties may be the result of either The differential diagnosis between carcinoma and benign prostatic hypertrophy is considered in the section on Cancer of the Prostate At times a neurogenic dysfunction masquerades as ordinary prostatism Furthermore the elderly patient with a neurogenic bladder frequently has some degree of prostatism as well A careful neurologic examination with particular attention to the perineal sensation, the tone of the anal sphincter peripheral reflexes, and the position and vibratory senses in the legs will almost invariably reveal a nervous deficit if the major cause of dysfunction is neurogenic Cancers of the bladder proper often cause misleading indications especially if their location at the vesical neck causes actual obstruction Finally many conditions producing most of the symptoms and many of the signs of prostatism are not actually obstructive in nature For example the patient with diabetes mellitus is likely to have frequency and nocturia but this is related to a large fluid turnover the total volume of urine is great and especially the total volume of each individual voiding is normal or larger than normal The patient with obstruction at the vesical outlet usually has small volumes at each voiding As another illustration any irritative lesion within the bladder for example carcinoma of the bladder tuberculosis and chronic renal infection is likely to cause urgency frequency nocturia, and pyuria

Treatment

As might be expected from what has been said about the rate of growth the natural course of the disease shows great variation among different individuals However the dangerous trend is toward destruction of the kidneys by obstruction and infection The obstruction alone or the infection alone can seriously damage the kidneys but the two together are much more destructive than a mere total of their two capacities When it is recalled that preexisting renal disease such as nephrosclerosis is very common in these older patients it is not surprising to find that serious renal impairment can appear rapidly On the other hand the many compensating factors in the urinary tract and the good fortune of having no preexisting renal disease may permit a long progression before uremia appears Before the development of the modern antiseptic drugs overwhelming

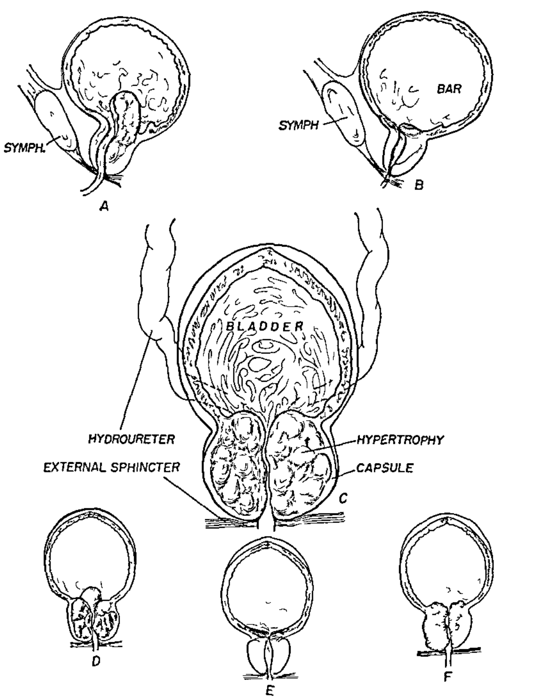


Fig. 24 5 Common causes of prostatism *A* Median lobe hypertrophy *B* Median bar at vesical outlet *C* Lateral lobe hypertrophy *D* Trilobed hypertrophy *E* Contracture of vesical outlet *F* Carcinoma (*From V F Marshall Textbook of Urology Hoeber New York* 1956 *By permission of the publisher*)

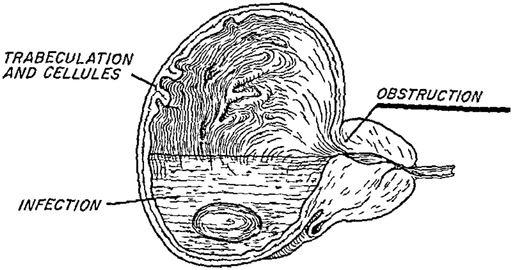


Fig 24 6 Primary vesical stone (*From V F Marshall Textbook of Urology Hoeber New York 1956 By permission of the publisher*)

sepsis frequently appeared at almost any point and cut short the patient s career This still happens but only occasionally Vesical calculi are equivalent to residual urine and largely the result thereof (Fig 24 6) Because of the increasing tendency to perform early prostatectomy, vesical calculi are not as common as they once were but they still constitute a significant complication requiring specific attention It is now generally appreciated that the removal of vesical calculi is only half the therapeutic program the other half being the relief of the more fundamental obstruction With hypertrophy of the bladder and cellule formation diverticula tend to form Since these diverticula appear at the points of the bladder with the poorest muscle and do, in fact represent a sort of blow-out of the bladder wall their decided tendency to empty poorly is easily understood Large vesical diverticula empty mainly because of the intraabdominal pressure and their disposition relative to the mechanics of the bladder can easily permit the retention of urine and infection The enlarged prostate itself usually becomes infected to some degree Finally the symptoms of prostatism may in themselves contribute to a deterioration in the patient s general status for example the patient s sleep may be seriously disturbed and attempts to reduce the frequency by low intake may cause dehydration and malnutrition

The definitive treatment aims at the removal of the hypertrophied masses which are causing the obstruction One of the most commonly employed methods of removing the hypertrophy is through a suprapubic transvesical approach In this operation the plane of cleavage between the true prostate and the hypertrophied masses is found with the finger and the hypertrophy bluntly enucleated Generally speaking the operation is highly successful in the adequate removal of the offending masses but the control of hemorrhage always a major consideration with any prostatectomy, requires special consideration While it is true that natural coagulation of blood and especially the natural contraction of the prostatic capsule will often control the bleeding, the mortality and morbidity have been high when all is left to nature once the lobes have been enucleated In the days before intravenous pyelography easy transfusions, and modern antiseptic drugs the mortality associated with this program ranged from 20 to 40 per cent and sometimes even higher While packing the prostatic bed with gauze is on rare occasions a necessary expedient for controlling hemorrhage this has many major disadvantages The packs are irritating foreign bodies which

abet infection They interfere with the natural contraction of the prostatic capsule and as we have noted this contraction is one of the important factors in reducing hemorrhage Secondary hemorrhage after the removal of packs is unfortunately no rarity Packs often induce painful bladder spasms and their removal is often painful too A tamponade with a variety of rubber bags is usually effective but these devices have similar disadvantages though in a definitely lesser degree The best method for controlling hemorrhage after any prostatectomy is visualization of the bleeding points with suture ligature or accurate point fulguration Adequate exposure for suturing can nearly always be obtained if the opening into the bladder has been liberally made and retraction properly applied In fact the incision can be carried well into the prostatic capsule to permit better spreading The arterial vessels entering the prostate are principally present at 8 and 4 o clock just in the prostatic side of the vesical neck after the enucleation If they cannot be immediately identified a figure-eight No 00 plain catgut suture can be placed in these areas and usually the vessels will be at least partially controlled so that they can be more specifically identified Searching for the blood vessels does increase the immediate blood loss in the operating room but the total loss over the period of the next several days is likely to be decreased by attending to the problem promptly and directly It is rarely necessary to suture the sites of venous bleeding as they nearly always stop through coagulation of the blood and the contracture of the capsule If there is a prominent rim of tissue at the floor of the vesical outlet the author removes a wedge of this tissue and usually draws vesical mucosa across the area suturing the edge of mucosa to the capsule of the prostate with a few plain catgut sutures During such maneuvers it is wise to place catheters in the ureteral orifices in order to keep them plainly in view It is the author s practice to leave a cystostomy tube in place following a suprapubic prostatectomy and usually also to leave a transurethral catheter of the Foley type in place This system permits a double exit of the urine and blood from the bladder Tight closure with dependence upon the transurethral catheter alone has been advocated and no doubt the system will give excellent results in many instances However there is little disadvantage to having a temporary cystostomy and many advantages It should also be mentioned that the author places the cystostomy tube as high in the bladder as possible and suspends this site from the rectus muscles with a suture (Fig 24 7) The method of leaving the cystostomy at any convenient point usually low frequently results in adherence to the back of the symphysis with subsequent downward contraction of the tract of the cystostomy so that the fistula competes closely with the vesical outlet If all is going well the cystostomy can nearly always be permitted to close within a week but if progress is not satisfactory this extra opening may be of major importance in controlling bleeding and infection and for urinary drainage The author has transurethrally coagulated the bleeding points immediately following the enucleation and this was usually successful However he prefers suture ligature as being more effective and also less cumbersome in operating room management From time to time some drug for topical application or of great coagulating potency (often as a pack) becomes fashionable The author has tried many and promptly discontinued their use Some act as foreign bodies and they are all likely to give a false sense of security After all their effect on arterial bleeding is minor and in usual circumstances venous bleeding is naturally controlled On rare occasions after any form of prostatectomy intractable and recurrent hemorrhage may occur If at all feasible the author s first maneuver is to attempt to resuture the bleeding points or at least to coagulate them electrically If this fails a tamponading rubber bag of suitable type (large Foley or Pilcher) is then inserted and put on transurethral tension of 1 or 2 lb Sometimes packing with gauze must be resorted to The possibility

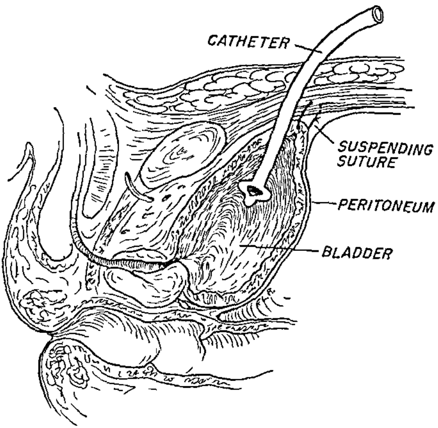


Fig 24 7 Cystostomy (*From V F Marshall Textbook of Urology Hoeber New York 1956 By permission of the publisher*)

of some unremoved semiviable hypertrophy being a cause of delayed hemorrhage must be borne in mind Ligation of one or both internal iliac arteries will reduce the arterial bleeding and these ligations have not led to a slough of the bladder or the prostate At the time of the original prostatectomy it is also possible to dissect down the *outside* of the prostate and place mattress sutures at 8 and 4 o clock at the junction of the prostate with the vesical neck On rare occasions the author has performed a total prostatectomy for the purpose of controlling recurrent hemorrhage However this has not always been successful, because the identification of structures may be difficult and the accurate placing of sutures in the friable tissues can be quite uncertain In all these secondary procedures clear identification of the ureteral orifices is highly desirable and accordingly worth much effort Generally speaking, convalescence is slower following suprapubic prostatectomy than after the other types of operation The technique of the operation can be readily learned, and for the occasional operator it is most probably the safest

Retropubic prostatectomy is actually a variation of the suprapubic approach (Fig 24 8) In the retropubic technique the bladder proper is not opened but the incision is made into the capsule of the anterior aspect of the prostate The same line of cleavage is followed and the hypertrophied masses removed in the same manner The methods for the control of hemorrhage are the same as those employed in suprapubic prostatectomy, except that with a wide incision in the prostate visualization of the bleeding points is often better It is the author s routine practice to remove a wedge of the vesical neck in the midline of the floor (Fig 24 9) where it is usually prominent after the masses have been enucleated When this was not done, contracture of the vesical neck occurred in a significant number of patients (probably 10 per cent had at least some difficulty of this

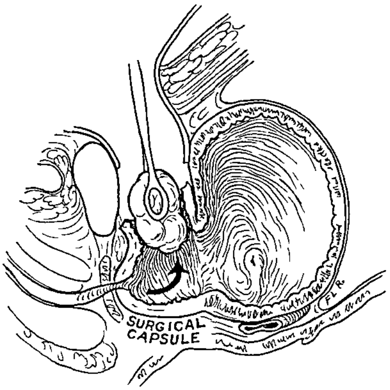


Fig 24 8 Retropubic prostatectomy (*From V F Marshall Textbook of Urology Hoeber New York 1956 By permission of the publisher*)

type postoperatively) Parenthetically the author has used this plastic revision successfully to correct severe and recurrent contracture of the vesical neck He does not hesitate to place a cystostomy tube high in the bladder when all does not appear highly satisfactory His reasons are essentially those outlined in the paragraph above The greatest disadvantage is usually the injury to the pride of the surgeon! Convalescence following the usual retropubic prostatectomy is rapid most patients being discharged within 2 weeks The operation is not as easily learned as suprapubic prostatectomy The incidence of incontinence and impotence is essentially the same following both these procedures that is sexual function is usually little changed and incontinence permanently present in 2 per cent or less

Transurethral prostatectomy is a highly artistic procedure requiring experience and skill (Fig 24 10) Even the instrumental assembly is complex and expensive The procedure is clearly contraindicated for anyone not thoroughly accustomed to the use of transurethral instruments Accidents may occur suddenly in the best of hands and the untrained operator is likely not to recognize such catastrophes immediately In spite of these and other disadvantages transurethral prostatectomy is the operation most commonly employed by the author 60 to 70 per cent of prostatectomies being carried out by this technique Perhaps the most appealing advantage is the rapid recovery of most patients with a return to urination through the normal passages within a mere few days There are no painful incisions and most patients are discharged within 10 days or less Sexual function is generally unchanged except that retrograde ejaculation into the bladder usually results When the hypertrophied mass is small or fibrous or both the other forms of prostatectomy are often technically difficult but transurethral excision can usually provide a highly satisfactory result The objective of the procedure is to remove all the obstructing and hyper

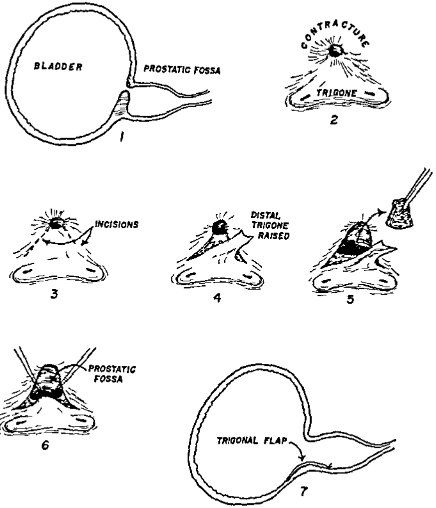


Fig 24 9 Plastic revision of posterior vesical neck for contracture

trophied tissue down to the surgical capsule of true prostatic tissue and to coagulate the bleeding points accurately In practice the author only occasionally removes more than 50 Gm transurethrally The incidence of un desirable end results increases abruptly when more than 50 to 60 Gm is removed The other forms of prostatectomy are usually facilitated by the presence of hypertrophied masses of 50 or more Gm and accordingly size is one item in the selection of operation The commonest cause of a poor result is in complete removal of the offending tissue Too liberal incisions in the region of the prostatic apex may result in incontinence Much depends upon the operator s recognition of his own limitations Perforation with urinary leakage should be recognized at the time it occurs and open surgical drainage with cystostomy in addition is nearly always advisable A small perforation of the prostatic capsule proper is, however usually of little consequence but a perforation of the bladder or at the junction of the bladder and the prostate is nearly always a serious matter requiring immediate attention Of course the irrigating fluid will extravasate through an opening in the bladder or vesical neck Furthermore the irrigating fluid does directly enter the blood stream when the venous sinuses are opened during this operation as happens in most cases Obviously the irrigating fluid should be compatible with intravenous injection The author has had satisfactory experience with 5 per cent dextrose in distilled water alone Recently he has been using a solution of glycine and has found it equally safe Before the use of these isotonic solutions the author had occasional disasters from renal shutdown which we

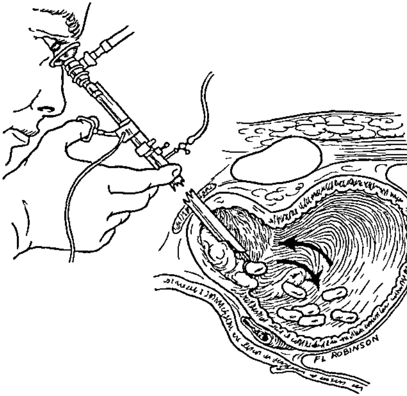


Fig 24 10 Transurethral prostatectomy

now know resulted mainly from renal tubular damage (so called lower nephron nephrosis) The amount of irrigating fluid which may enter the general circulation during the course of a transurethral prostatectomy is at times very surprising By means of weighing the patient and tabulating all factors the author has been able to demonstrate intravenous injection of over 1 000 cc in many cases Such an addition to the circulation may be of serious import for a patient in borderline cardiac compensation In short transurethral prostatectomy is a highly specialized procedure having distinct advantages and disadvantages In skillful hands against hypertrophies of moderate size the advantages usually outweigh the disadvantages

Although not a new operation conservative perineal prostatectomy has not been widely employed Even in its present greatly improved status it is used mainly in teaching institutions and by a few specialists in the technique The author feels that this is unfortunate because in his experience and that of others this procedure has been consistently followed by the lowest postoperative mortality This is true in the author s experience even though he tends to employ the operation more in difficult circumstances than in favorable ones Perhaps the greatest deterrent to the more general use of this operation is and has been the specific training necessary for performance Also improvements in the other forms of prostatectomy have reduced the frequency of situations in which the perineal approach is clearly the most advantageous The publicity given to the complications of incontinence fistula and impotence has bolstered the natural bias of many surgeons against the work necessary to learn the technique Incontinence following the conservative operation is rare and probably little different from that following transurethral prostatectomy in the hands of the average operator Permanent perineal urinary fistula has been exceedingly rare in the author s experience If injury to the rectum occurs a fistula between the bowel and

the bladder does not invariably follow, but it is true that such a fistula will require a major secondary operation, which is usually successful How frequently a conservative perineal prostatectomy is the cause of sexual impotence cannot be stated with certainty The author s impression is that impotence is common following perineal operations If sexual potency after operation is a major consideration *relative to the other circumstances* in a particular case, the author tends to avoid the perineal approach This attitude may not be altogether fair to the operation since the organic causes of impotence are poorly understood and since postoperative impotence is not limited to the perineal operation In fact, a significant percentage of candidates for prostatectomy are already impotent The perineal approach does provide the best visualization for exploration and biopsy If a curable carcinoma is demonstrated, the curative operation can be immediately carried out through the exposure already made The exposure also permits accurate suturing of bleeding points following the removal of tissue Dependent drainage through the incision is a major influence in reducing infection even in these days of powerful antiseptic drugs Convalescence is usually rapid even after the removal of very large masses Although it would seem that the exaggerated lithotomy position necessary to the performance would be a great strain on the cardiovascular and respiratory systems the author s experience is that this strain has been much less than anticipated and actually has rarely been a major consideration Like transurethral prostatectomy the perineal operation readily permits early ambulation of the patient even if he is old and feeble Finally particular circumstances sometimes exist in which this type of operation is clearly superior as will be illustrated shortly

A complete or total prostatectomy is only rarely required in the absence of cancer In rare cases however, the prostatic capsule is so fibrous and so riddled with pockets of infection that such an extensive removal is in order The author has often performed a subtotal perineal prostatectomy in which the bleeding points can be particularly easily identified and controlled without adding significantly to the other dangers, except that all forms of total prostatectomy invariably result in sexual impotence Total prostatectomy can also be accomplished by the retropubic route with essentially the same late results as those following the perineal exposure The principal advantage of retropubic total prostatectomy to the author has been that this approach makes the pelvic nodes readily available for exploration Total and subtotal prostatectomies have the advantage that some small carcinomas previously unsuspected may be removed and the cure rate in these circumstances has been high Finally, these procedures are the nearest to a guarantee of no recurrent urinary obstruction

Patients undergoing prostatectomy of any sort routinely have a bilateral ligation and division of the vasa through tiny scrotal incisions This does reduce the incidence of postprostatectomy epididymitis Most candidates for prostatectomy are no longer interested in their fertility and little is added to the magnitude of the procedure by performing the ligations Epididymitis can still occur following ligation but this is rare An acute epididymitis can be extremely debilitating for the poor risk patient

Blood loss is always an important consideration with any prostatectomy The mechanical control of bleeding has already been discussed but adequate replacement is also important The majority of the author s patients receive transfusions in the operating room Most methods for the determination of blood loss require significant work and time However a backlog of experience in which accurate measurements were made greatly aids the operator in making the routine estimation from which he must prescribe The author found that he had tended to give too much water and too little blood and thus had tended to support the circulation with water when the actual deficit was one of blood Now he administers 5 per cent dextrose in water slowly and sparingly but be

gins blood transfusions almost prophylactically The author has found the most practicable method for the routine estimation of operative blood loss to consist in accurately weighing the patient immediately before the operation and immediately upon his removal from the table and then mathematically balancing the change with the carefully recorded intake and the losses (including an estimate of insensible losses as based upon previous studies) Although he does not employ this measurement in *every* case as it has not been always necessary the method is particularly valuable when the margin of security is small or the difficulties great In the post operative management of the patient an accurate record of the intake and output compared with the basal weight of the patient each morning can provide immediate indications relative to fluid and electrolyte balance Such information is of great importance when it is remembered that cardiovascular upsets are among the commonest causes of postoperative death in this age group

The author feels strongly that all four types of prostatectomy should be taught and practiced because one may be clearly more appropriate than the other in a particular circumstance This is merely saying that the therapeutic program should be tailored to fit the patient rather than the patient squeezed into a rigid routine which may not be the best available for him Perhaps three specific examples will illustrate this point Patient B had bony deformities which made the perineal approach impossible The prostatic urethra was so distorted that instrumentation could not be carried out He was however a slender man with a moderate sized prostate and a suprapubic prostatectomy provided a good result A retropubic prostatectomy would also have been applicable but both perineal and transurethral prostatectomies were nearly impossible Patient I was a short extremely obese man who could not be placed in a desirable position for perineal prostatectomy His abdomen was so extremely obese and pendulous as to constitute a serious handicap if the operator were to attempt suprapubic or retropubic prostatectomy Although the transurethral electrotome would not reach from the end of the penis into the bladder a perineal urethrostomy permitted its introduction and a transurethral prostatectomy provided an excellent result Patient S was a feeble 82 year-old man with a large prostate severe arteriosclerosis and significant infection The gland was grossly too large for the transurethral capabilities of the operator His massive and flappy abdomen was not favorable to the suprapubic or retropubic approaches A subtotal perineal technique readily removed 144 Gm facilitated accurate control of bleeding by suturing provided adequate dependent drainage of his infection and permitted prompt ambulation Sexual considerations were of no importance in this case

Compromise Procedures

It is not always possible to proceed promptly or even eventually with the removal of the obstructing tissue Then compromise procedures must be employed usually because of the patient s poor general status poor renal function or both Although an exact chronologic age beyond which extraordinary caution should be employed cannot be dogmatically given the author does feel that any patient near 90 years of age should be most cautiously and conservatively managed even though he may appear to be a good risk At such an advanced age compromise procedures must always be considered the same as for the poor risk younger patient The temporary use of a transurethral catheter is of course most valuable However this is a foreign body which irritates and obstructs the urethra and prostate while the bladder is being drained An indwelling catheter is usually better than intermittent catheterization since the latter will add the risk of recurrent acute trauma at frequent intervals Furthermore intermittent catheterization does not provide the maximum constant drainage which many of these patients need Before prostatectomy became a relatively safe therapy the use of a trans

urethral catheter was a frequent substitute Few patients treated in this manner survived more than 1 year even with the best of care Improved techniques and especially the intelligent use of modern antiseptic drugs do however, provide more range for the employment of catheters today

Probably the most useful of the compromise procedures in the management of patients with prostatic obstruction is suprapubic cystostomy As mentioned earlier the author tries to place the opening at the highest point in the bladder and to suspend this with sutures from the rectus muscle The urethra and prostate remain unmolested and may drain either into the bladder or down the urethra The amount of foreign body present within the urinary tract is small, although still significant The author maintains the catheter open at all times and instructs the patient or his caretaker to irrigate the tube once daily alternating between boiled water and Suby s solution G If a second-stage procedure does become feasible the high position of the cystostomy readily permits further opening of the bladder downward for a suprapubic or retropubic type of operation Sometimes renal damage is so great that even cystostomy drainage will not permit satisfactory functional return Also, the lack of such a return has on occasion indicated that the patient has principally or in significant addition, nonobstructive nephropathy such as nephrosclerosis or severe glomerulonephritis The importance of visualizing the architecture of the upper urinary tract at some early point can hardly be overemphasized The patient with prostatic obstruction and uremia but no hydronephrosis must be suspected of having nephropathy of another sort On rare occasions there is secondary obstruction in the ureters resulting from fibrosis and angulation particularly at the ureterovesical junction

Indications for Prostatectomy

There is little difficulty concerning indications of a severe nature which justify prostatectomy but outlining the minimal indications which still justify operation is not easy Many considerations for and against operation have to be weighed in the balance, and this calls for judgment on the part of the surgeon Early operation tends to provide safety and better results, but at the same time no prostatectomy is completely without prospect of mortality and morbidity Clearly mere enlargement of the prostate without any other indications is not sufficient A large residual urine, even if the patient is nearly asymptomatic and uninfected is usually enough to justify the operation particularly if the patient s general status is good Persistent or recurrent infection is likewise such a serious threat as to be a major indication Impending renal impairment is surely sufficient justification, if one is truly able to say that it is actually impending Sometimes the symptoms are sufficiently severe that they alone necessitate the operation, but the decision requires cautious judgment since diagnosis and conservative therapeutic trials are often found to have been inadequate when operation for symptoms alone has been advised On rare occasions hemorrhage from the enlarged prostate requires a prostatectomy and the author has performed at least two in the past few years as emergency procedures for this reason A suspicion of the presence of operable carcinoma in addition to other mild indications may add up to sufficient justification All considered it is not possible to draw a sharp line between those patients who do not quite have enough indications to justify prostatectomy and those who just barely do

Results

In general the results of prostatectomy when carefully performed on adequate indications are quite good Mortality rates generally are well below 5 per cent and for several years in the author s cases have remained below 2 per cent Some of the reasons for these low rates have been indicated but this favorable circumstance is also part of the improvement in the total picture For example, 5 873 consecutive urologic operations

of all types in a 5 year period were followed by 67 deaths in The New York Hospital a rate of 1 1 per cent At least 90 per cent of patients after prostatectomy will return to normal or near normal urinary habits with clear urine and will have their kidneys ade quately protected Furthermore 90 per cent or more of these will maintain this status permanently Overwhelming acute sepsis is now a rare cause for mortality but persistent chronic inflammation within the kidneys is still a major hazard Many of these examples of chronic pyelonephritis are so well estab lished that they will not completely stop even with adequate drainage and the use of mod ern powerful drugs A fatality from hemor rhage is now exceedingly rare Cardiovascu lar complications however are the common est causes of early death following prosta tectomy Cardiac decompensation coronary occlusion cerebrovascular accident and pul *monary embolism can never be forgotten in* the postoperative management In a small percentage the late morbidity is significant that is infection fails to clear symptoms continue or renal damage progresses When one of these difficulties is persistent a com plete reevaluation of the case is in order The patient may well have persistent obstruc tion resulting from incomplete removal of the offending tissue or from the acquisition of strictures Occasionally calculi have formed Secondary obstructions and poorly draining diverticula are potent sources for persistent infection At times a carcinoma in the blad der or the prostate has been overlooked or the patient actually had some disorder other than prostatism such as neurologic disease or urinary tuberculosis Occasionally a chronically and severely overstretched blad der does not regain sufficient tone to permit adequate emptying These patients are usu ally asymptomatic but the infection often will not clear *completely If the obstructing* tissue has been adequately removed a liberal resection of the overstretched bladder some times improves the mechanics of emptying but many patients tolerate their mild infec tion for years with little trouble under these circumstances Unfortunately, there is little to be done for the adequate correction of postprostatectomy incontinence but it is im- portant to know that natural processes do correct the majority of those in which the incontinence is incomplete Such natural cor- rection often requires a year or more Op- erations for correction of postprostatectomy incontinence are legion but the desired re sults are rarely obtained The search is still going on Mention has already been made concerning fistula and impotence Supra- pubic hernias are most likely to occur in the older patients whose general condition is not good and who develop a significant wound infection following the operation The author tries to avoid a midline incision directly through the linea alba and prefers to open the rectus sheath over one of these muscles well away from the midline and then to re tract the muscle laterally At the time of *closure the muscle is loosely attached to its* mate with a few sutures and thus the wound becomes imbricated The cystostomy tube if any can be brought out through a stab wound through the muscle belly

In summing up the following conclusions may reasonably be made Early prostatec- tomy is justified indeed desirable, but there must be definite indications since the mor tality and morbidity are not zero and since the results are not invariably perfect Judg ment is therefore required Each type of prostatectomy has its place and the urolo- gist should be able to perform each The therapeutic program should be selected for the patient on the basis of the information obtained from an accurate and detailed eval uation not only of the urinary tract but of the patient as a whole The patient should not be made to fit into a rigid routine thera peutic program With careful evaluation proper selection of the therapeutic effort and *skilled application of techniques procrasti* nation in the presence of justifying indica tions is to be condemned because treatment is generally safer and more comforting than the usual natural course of the disease In fact these increasingly satisfying results have

removed much of the stimulus to study the cause of benign prostatic hypertrophy A preventive is needed, as is a set of indications for the application of this preventive Until such a prophylactic program is available, obstruction by benign prostatic hypertrophy will continue to be a common disorder of older men and, in fact, a larger number of these obstructions will actually be seen because of the increase in the population and the rise in the proportion of older persons in this population

BIBLIOGRAPHY

Baron E and Angrist A Incidence of Occult Adenocarcinoma of the Prostate After 50 Years of Age Arch Path 32 787 1941

Batson O V The Function of the Vertebral Veins and Their Role in the Spread of Metastases Ann Surg 112 138 1940

Clarke B G Leadbetter W F and Campbell J S Implantation of Cancer of the Prostate in Site of Perineal Needle Biopsy Report of a Case J Urol 70 937 1953

Creevy C D Carcinoma of the Prostate Gland J A M A 138 412 1948

Flocks R H Kerr, H D Elkins H B and Culp D Treatment of Carcinoma of the Prostate by Interstitial Radiation with Radioactive Gold A Preliminary Report J Urol 68 510 1952

Foot N C Humphreys G A and Coats E C Carcinoma of the Prostate A Review of 162 Cases with a Pathologic Classification New York J Med 50 84 1950

Huggins C and Hodges C V Studies on Prostatic Cancer The Effect of Castration of Estrogen and of Androgen Injection on Serum Phosphatases in Metastatic Carcinoma of the Prostate Cancer Res 1 293 1941

Huggins, C and Johnson M A Cancer of the Bladder and Prostate J A M A 135 1146 1947

Jewett H J Radical Perineal Prostatectomy for Early Cancer Bull New York Acad Med 34 26 1958

Marshall V F Subtotal Perineal Prostatectomy J Urol 52 250 1944

Moore R A The Morphology of Small Prostatic Carcinoma J Urol 33 224 1935

Munger A D Experiences in the Treatment of Carcinoma of the Prostate with Irradiation of the Testicles J Urol 46 1007 1941

Nesbit R M and Baum W Endocrine Control of Prostatic Carcinoma J A M A 143 1317 1950

Paquin Albert J Jr Marshall Victor F and Nathanson Bernard Studies on a Practical Method for the Determination of Operative Blood Loss Ann Surg 141 53 1955

Randall H T Pearson, O H West C D Hollander V P and Whitmore W F The Effect of Bilateral Adrenalectomy upon Neoplastic Disease in Man Cancer 5 1009 1952

Ray B S and Pearson O H Hypophysectomy in the Treatment of Advanced Cancer of the Breast Ann Surg 144 394 1956

Rich A R On the Frequency of Occurrence of Occult Carcinoma of the Prostate J Urol 33 215 1935

Tagnon H J Whitmore W F and Shulman N R Fibrinolysis in Metastatic Cancer of the Prostate Cancer 5 9 1952

Young H H The Cure of Cancer of the Prostate by Radical Perineal Prostatectomy (Prostato seminal Vesiculectomy) History Literature and Statistics of Young's Operation J Urol 53 188 1945

25

Vesical Neoplasms

Victor F Marshall

Vesical carcinomas constitute about three per cent of all cancers (other than skin) and accordingly may be considered neither rare nor common In one large series from The New York Hospital–Cornell Medical Center the average age of patients with this disease was 59 years but many patients were in the seventh and eighth decades and some were even older While the incidence of the disease does not appear to be changing more accurate diagnosis and a large number of older persons in the population does increase the actual number of cases being encountered Why the disease is two or three times more common in men than in women has never been explained Speculation has led to unsuccessful attempts at modifying the disease by hormonal variations The author once had the impression that the disease was less severe in women but this could not be demonstrated in a detailed study of a large number of cases These neoplasms can be produced in animals and in human beings by repeated exposures to a few chemicals of which beta naphthylamine and benzidine are well recognized both experimentally and clinically Furthermore the cancerogenic element in such cases is excreted in the urine Since the recognition of this causation improved production methods and safeguards against excessive exposure have reduced the incidence in that small portion of aniline dye workers who are subject to this occupational hazard However such recognizable exposure is actually rare even among the large group of patients with vesical neoplasms whom the author has seen over the past 25 years

DIAGNOSIS

The diagnosis of vesical neoplasms in the aged is arrived at in essentially the same manner as it is in younger persons Gross hematuria which is the first clear sign in about three fourths of cases does not seem to frighten the older person into activity as readily as the younger Persistent vesical irritation however sooner or later forces the victim to seek relief Even then there is a great tendency to attribute the difficulty to a little prostatic trouble or some euphemistic disorder for example cold in the bladder Blood in the urine is abnormal at any age and a high percentage of patients with this complaint have serious diseases for example at least 20 per cent of those who have gross hematuria have cancer in the urinary tract Once the neoplasm is more than incipient secondary infection is the rule The modern powerful antiseptic drugs will temporarily reduce this infection and thus relieve the symptoms but a delay engendered by false security lets the cancer grow Pus or blood or both in the urine can nearly always be traced to the source This search usually requires pyelography cystoscopy and biopsy in addition to an accurate history and physical examination The extent of the growth the direct effects of this extent (especially on the kidneys) and the general con

dition of the patient require study before the therapeutic plan can be intelligently outlined

Grading and Staging

Vesical neoplasms present a complete panorama of malignancy from the quite benign to the rapidly lethal Over 95 per cent are derived from the transitional epithelium The author will confine his discussion to this 95 per cent except to note that the rare types, such as fibromyomas and sarcomas, have been found in aged persons A measure of the growth potential and an estimate of how far this potential has already enabled the neoplasm to extend should give prognostic clues to guide therapy The most practical albeit inexact measure of inherent vigor is histologic grading Grading has been shown to have a general correlation with the actual course with frequent exceptions A minute superficial lesion with a high degree of histologic malignancy would seem to be therapeutically different from its counterpart of the same grading which invaded deeply and widely into the muscle of the bladder Jewett and Strong and Aschner, have shown that extent of the growth has been a better prognostic indication than grading alone As a consequence of these considerations the author uses a dual classification based on both histologic grading and physical extent If there was only one effective treatment available such a classification would be of little clinical use, but several valuable forms of therapy may be employed Furthermore methods effective against one neoplasm may prove useless against another Different types of treatment also carry quite different risks Each neoplasm should be carefully classified as a major step in the accurate diagnosis upon which treatment is to be based Histologic grading is determined from study of an adequate biopsy A resectoscope is utilized to obtain adequate representative portions When large lesions are present it is advisable to remove the neoplastic tissue which protrudes above the general level of the interior surface of the bladder as a separate specimen and then to obtain deeper specimens While most neoplasms are of the same degree of malignancy throughout there are frequent variations and often the highest degree of malignancy is found in the deeper biopsies The deep biopsies often provide proof of extent into muscle and even into fat Pathologists differ in their grading techniques and in their nomenclature It makes no difference in the individual case what name is placed on the growth as long as the urologist understands exactly what the particular pathologist means Many pathologists use a limited number of classifications but the objective is to treat patients not to oversimplify grading by omitting useful categories The important consideration is that the managing surgeon have as much information as possible about the neoplasm and whether or not it is likely to invade or metastasize The author prefers to classify the lowest type of epithelial neoplasm as *papilloma* and to use the term *cancer* for the higher varieties with an invasive and metastasizing potential

Diagnostic Procedures

The extent of the neoplasm particularly the depth to which it has penetrated the vesical wall can be estimated with a significant accuracy in 80 per cent of cases before open exploration The cystoscopic appearance and the accurate biopsy as described are important in making the estimate Jewett has particularly emphasized the bimanual palpation of the bladder in determining the extent Such palpation is done best during a relaxing general or spinal anesthesia although the author rarely uses the latter Neoplasms invading less than halfway through the muscle layer usually cannot be felt, but those deep in the muscle or barely encroaching into the perivesical fat can usually be made out as at least a rubbery induration (Fig 25 1) Massive invasion into the perivesical fat usually produces a definite firm nodular induration Mobility and extension into adjacent organs especially the prostate should also be estimated by palpation Vis

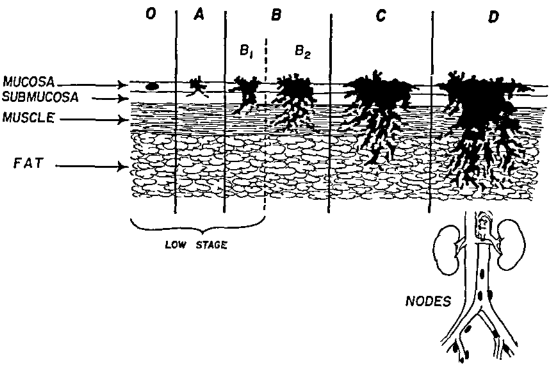


Fig 25 1 Stages of vesical carcinoma (*From V F Marshall Textbook of Urology Hoeber New York* 1956 *By permission of the publisher*)

ualization through the cystoscope at the time of bimanual palpation sometimes conveys additional or confirmatory information In flammatory induration may make the neo plasm occasionally appear much more extensive than it truly is On the other hand a carcinoma of high grade malignancy is com monly more extensive than the first estima tion suggests If an accurate biopsy reveals a low grade the palpatory estimate is usually correct but if the growth is of high malig nancy the diagnostician should seriously consider revising his estimate upwards In other words there is a relation between grade and stage and grading does aid in staging Furthermore all other features which may indicate extent are also employed Obviously radiographic evidence of metastasis is of ex treme importance in staging The appearance of a cystogram is often useful and the pres ence of ureteral obstruction as revealed by intravenous pyelography usually indicates at least some muscle invasion

The examination of urinary sediment smears by the Papanicolaou technique is quite useful in the detection of carcinomas of the bladder but is of little importance in stag ing Histologically benign papillomas usually exfoliate a large number of cells into the urine but these vary so little from normal ones that a positive diagnosis of papilloma cannot often be made On the other hand cancer cells are usually readily detected and when they are found the author s experience in several hundred cases demonstrates that cancer is present in at least 95 per cent The author has detected unsuspected cancers carcinomas in situ cancers inaccessible in diverticula and even a few carcinomas months or years before other diagnostic tests revealed them However it is most important to realize that the Papanicolaou method is decidedly limited as a test to exclude the presence of cancer in the urinary tract Three properly prepared specimens in which neoplastic cells are not detected by a cytologist trained in the method do constitute useful evidence against the presence of a vesical carcinoma but even this evidence alone is not conclusive

dition of the patient require study before the therapeutic plan can be intelligently outlined

Grading and Staging

Vesical neoplasms present a complete panorama of malignancy, from the quite benign to the rapidly lethal Over 95 per cent are derived from the transitional epithelium The author will confine his discussion to this 95 per cent except to note that the rare types, such as fibromyomas and sarcomas have been found in aged persons A measure of the growth potential and an estimate of how far this potential has already enabled the neoplasm to extend should give prognostic clues to guide therapy The most practical albeit inexact measure of inherent vigor is histologic grading Grading has been shown to have a general correlation with the actual course with frequent exceptions A minute superficial lesion with a high degree of histologic malignancy would seem to be therapeutically different from its counterpart of the same grading which invaded deeply and widely into the muscle of the bladder Jewett and Strong and Aschner have shown that extent of the growth has been a better prognostic indication than grading alone As a consequence of these considerations the author uses a dual classification based on both histologic grading and physical extent If there was only one effective treatment available such a classification would be of little clinical use but several valuable forms of therapy may be employed Furthermore methods effective against one neoplasm may prove useless against another Different types of treatment also carry quite different risks Each neoplasm should be carefully classified as a major step in the accurate diagnosis upon which treatment is to be based Histologic grading is determined from study of an adequate biopsy A resectoscope is utilized to obtain adequate representative portions When large lesions are present it is advisable to remove the neoplastic tissue which protrudes above the general level of the interior surface of the bladder as a separate specimen and then to obtain deeper specimens While most neoplasms are of the same degree of malignancy throughout there are frequent variations and often the highest degree of malignancy is found in the deeper biopsies The deep biopsies often provide proof of extent into muscle and even into fat Pathologists differ in their grading techniques and in their nomenclature It makes no difference in the individual case what name is placed on the growth as long as the urologist understands exactly what the particular pathologist means Many pathologists use a limited number of classifications but the objective is to treat patients not to oversimplify grading by omitting useful categories The important consideration is that the managing surgeon have as much information as possible about the neoplasm and whether or not it is likely to invade or metastasize The author prefers to classify the lowest type of epithelial neoplasm as papilloma and to use the term cancer for the higher varieties with an invasive and metastasizing potential

Diagnostic Procedures

The extent of the neoplasm particularly the depth to which it has penetrated the vesical wall can be estimated with a significant accuracy in 80 per cent of cases before open exploration The cystoscopic appearance and the accurate biopsy as described are important in making the estimate Jewett has particularly emphasized the bimanual palpation of the bladder in determining the extent Such palpation is done best during a relaxing general or spinal anesthesia although the author rarely uses the latter Neoplasms invading less than halfway through the muscle layer usually cannot be felt but those deep in the muscle or barely encroaching into the perivesical fat can usually be made out as at least a rubbery induration (Fig 25 1) Massive invasion into the perivesical fat usually produces a definite firm nodular induration Mobility and extension into adjacent organs especially the prostate should also be estimated by palpation Vis

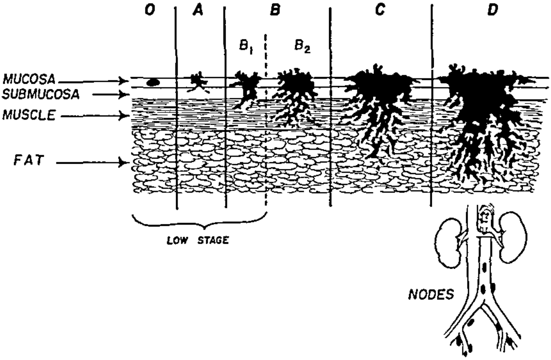


Fig 25 1 Stages of vesical carcinoma (*From V F Marshall Textbook of Urology Hoeber New York 1956 By permission of the publisher*)

ualization through the cystoscope at the time of bimanual palpation sometimes conveys additional or confirmatory information In flammatory induration may make the neo plasm occasionally appear much more exten sive than it truly is On the other hand a carcinoma of high grade malignancy is com monly more extensive than the first estima tion suggests If an accurate biopsy reveals a low grade the palpatory estimate is usually correct but if the growth is of high malig nancy the diagnostician should seriously consider revising his estimate upwards In other words there is a relation between grade and stage and grading does aid in staging Furthermore all other features which may indicate extent are also employed Obviously radiographic evidence of metastasis is of ex treme importance in staging The appearance of a cystogram is often useful and the pres ence of ureteral obstruction as revealed by intravenous pyelography usually indicates at least some muscle invasion

The examination of urinary sediment smears by the Papanicolaou technique is quite useful in the detection of carcinomas of the bladder but is of little importance in stag ing Histologically benign papillomas usually exfoliate a large number of cells into the urine but these vary so little from normal ones that a positive diagnosis of papilloma cannot often be made On the other hand cancer cells are usually readily detected and when they are found the author s experience in several hundred cases demonstrates that cancer is present in at least 95 per cent The author has detected unsuspected cancers carcinomas in situ cancers inaccessible in diverticula and even a few carcinomas months or years before other diagnostic tests revealed them However it is most important to realize that the Papanicolaou method is decidedly limited as a test to exclude the presence of cancer in the urinary tract Three properly prepared specimens in which neo-plastic cells are not detected by a cytologist trained in the method do constitute useful evidence against the presence of a vesical carcinoma but even this evidence alone is not conclusive

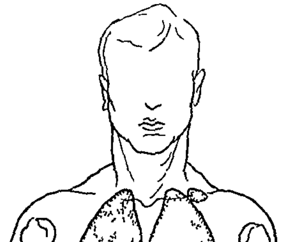


Fig 25 2 Sites of metastases from cancer of the bladder Black most frequent shaded next frequent (*From V F Marshall Textbook of Urology Hoeber New York 1956 By permission of the publisher*)

Metastasis

For many years it was commonly thought that vesical neoplasms metastasized late Some metastasize late or not at all but others metastasize early The commonest first site of metastasis is in a clinically silent area the lymph nodes inside the bony pelvis (Fig 25 2) As might be expected the more vigorous neoplasms tend to metastasize more promptly than those less malignant These *more vigorous growths* also tend to invade early, cause ureteral obstructions, etc Many patients with the highly malignant types die of urinary *obstruction infection before their* metastases are detectable Carcinomas invading the vesical wall less than halfway through the muscle layer have rarely metastasized only 1 of 41 in one of the author s series had done so Carcinomas well beyond the half level of the muscle do frequently *metastasize Stated differently*, very few patients with metastases have superficial tumors, but many patients with deep growths have metastases Thus the patient with an epithelial neoplasm clearly no more than barely invading muscle can reasonably be expected not to have metastases and may *justifiably be treated accordingly The patient* with a carcinoma deep in the muscle may well *have* metastases and accordingly diagnostic exploration of the primary metastatic echelon will frequently be in order to avoid inadequate or unnecessary treatment

The author s diagnostic approach may be *summarized as follows An accurate history*, a careful physical examination and a routine urinalysis form the foundation A specimen for Papanicolaou examination is usually obtained at this time also If there is gross hematuria an emergency cystoscopy to locate the source is highly desirable Intravenous *pyelography will not only provide crucial information concerning the vitally important upper urinary tracts and some indication* about stage but also the films are a rough survey for bony metastases Cystoscopic examination accurate biopsy, and bimanual examination under anesthesia are the fundamental methods not only to prove the presence of the neoplasm, but also to estimate *its extent or stage The patient* is a whole must be evaluated to estimate what he can withstand and to detect distant *metastases* Then if the growth is estimated to be not superficial the author strongly *inclines to* ward a diagnostic pelvic node dissection (at least ipsilateral), other circumstances permitting With all the above data at hand the form of therapy most likely to be effective can be intelligently balanced against the risks of the treatment itself By use of prognostic

classification such as the one presented much of the previous confusion concerning the results of treatment is being removed

TREATMENT

Older persons do have a lower actuarial expectancy than younger ones but do the older patients with vesical neoplasms fare less well than their younger counterparts *relative to their expectancy from each age?* While experience with patients beyond the age of 80 is insufficient to permit a reliable answer any reduction for those under 80 in survival *relative to actuarial expectancy* is so small as to be of no practical importance In other words the older (but younger than 80 years) patients fail to reach their expectancy by about the same degree as do their younger counterparts Of course more older patients will die in a given period but also more older persons in the general population die The failure of older patients with vesical neoplasms to reach their actuarial expectancy is not detectably greater than that of younger victims with closely similar growths managed in the same fashion

Radiation Therapy

Because of dissatisfaction with the results following the then current methods of radiation therapy a primarily surgical program was instituted about 15 years ago at The New York Hospital–Cornell Medical Center and in conjunction with the urological service at the Memorial Center for Cancer and Allied Diseases While the author is far from satisfied with the results they have been an improvement and at present the author is not inclined to revert to a program of irradiation In that era of radiotherapy nearly half the patients who were autopsied showed no metastases The most common cause of death in this group was renal obstruction infection Since instituting the surgical program most patients have died with cancer This is of course a paradoxical improvement since the fatalities are just as deadly in one group as the other! However the impression is unavoidable that a significant number must have lived longer to permit readily recognizable cancer to develop or put in another manner that fatal renal obstruction infection was so delayed that the cancer proper had more time The management of renal obstruction infection is fairly well understood but the cure for cancer remains elusive The author once published 5 year survival figures concerning all patients who had a histologic diagnosis of vesical cancer (exclusive of papilloma) during the era of radiation therapy 14 per cent survived 5 years and 6 per cent appeared to be free of cancer at 5 years Ninety per cent of these had some form of radiation implantation of gold radon seeds especially and almost half had external radiation as well These figures were attacked as being wrong but an independent survey essentially confirmed them Such 5 year statistics are little different from those found in a series of untreated cases While not absolutely comparable these items are as nearly so as any yet available Techniques of irradiation have been much improved particularly in permitting a larger tumor dosage with less damage to superficial tissues and with better localization to the area of the growth If the problem were simply one of getting enough ionizing radiation into the cancerous area cancer of the bladder would long since have ceased to be a problem because practically any amount has been deliverable for years The real difficulty is that the differential between the response of the cancerous cells and of the normal cells is quite small that is the radiation that kills the neoplastic cells also usually kills the normal cells The neoplastic cells and the normal cells are intimately intermingled and the proportions of each vary in different parts of the lesion for example from the center toward the periphery Many attempts have been made to induce the cancerous cells to take up a lethal poison such as some radioactive compound which the normal cells would not accept Radioiodine against carcinoma of the thyroid is such a poison but something similar for vesical neoplasms remains unknown

and even the treatment of thyroid cancer in this manner still leaves much to be desired A *large representative* series of *accurately classified* vesical *neoplasms treated by the most* modern radiological methods has not yet been reported Notable enthusiasm for these new techniques has been shown by many incomplete but quite optimistic presentations The author has treated more than 20 patients with histologic proof of metastases A million volt x ray machine a betatron and a radiocobalt installation have been used often in addition to more conventional irradiation or even local application of apparently suitable modern radioactive materials Thus far all cases are known failures Perhaps the efforts of radiotherapists should be directed against the less malignant tumors The results would probably be better, but would they be better than nontreatment or surgical treatment *against similar growths?* As we shall soon note the surgical treatment of the least malignant vesical neoplasms is highly successful, although not ideal and that fact constitutes a significant barrier to irradiation The concept of prophylactic irradiation of the bladder in cases of recurrent growths has been as recurrent as the tumors yet a demonstration of practical effectiveness is still missing Perhaps a full cancericidal dose is effective in reducing the rate of recurrence but full dosage is most likely to increase at least the symptoms, even if the recurrences happen to be prevented As a palliative temporary measure, small dosage to the whole *bladder by external irradiation often seems* to reduce nonarterial bleeding Among the many enticing features of radiation therapy is its adaptability to mathematical demonstration that a desired dosage can be delivered to the involved spot within seemingly practicable limits While this demonstration is certainly a proper step a significant gap exists between effects in a phantom and in the living body Furthermore a certain dosage may *kill half the neoplastic cells* but it does not follow that twice the dose will kill every one particularly without killing too many normal cells also Not only are better methods of irradiation needed but also better methods to predict susceptibility While no doubt exists that radiation has cured many vesical neoplasms, the true question concerns the price of such success compared with that of other methods against similar growths Current information is not sufficient to provide a conclusive answer but the author s experience forces him to favor surgery over irradiation at this time

Surgical Treatment

The author s present surgical program is outlined in Fig 25 3 and the gross survival rates may be noted in Table 25 1 It is most

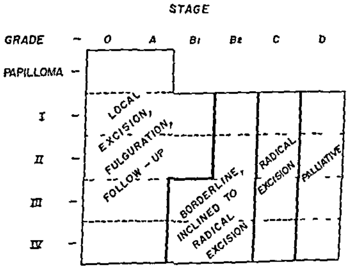


Fig 25 3 The initial surgical treatment of vesical neoplasms

TABLE 25-1 FIVE-YEAR SURVIVALS AFTER TREATMENT

	No of patients	Per cent
Local excision fulguration and follow up		
Papilloma	138	79–88
Low-grade low-stage	69	83
High-grade low-stage	17	77
High-grade high stage (stage D uncertain)	18	17
Simple segmental resection		
Low-grade low-stage	37	65
High-grade low-stage	25	56
High grade high-stage (stage D uncertain)	48	29
Simple total cystectomy		
Low-grade low-stage	36	47
High-grade low-stage	32	25
High-grade high-stage (including stage D certain)	79	9
Stage D only	24	4
Radical total cystectomy		
Low-grade low-stage	31	38
High grade low-stage	18	55
High-grade high-stage (including stage D certain)	100	8
Stage D only	50	4

important to realize that other factors in addition to stage and grade have influenced the selection of therapy for example rapidity of recurrences and diffuseness have influenced selection toward the more extensive forms of treatment listed toward the lower part of the table Specifically the data in the table do *not* necessarily demonstrate that local excision and fulguration are invariably superior to other therapeutic forms in every case of low grade and low stage neoplasm for example extremely diffuse and rapid recurrences of papillomas may on rare occasions justify cystectomy While survival is not the only measure of failure or success how long patients live can be objectively assaved Also most patients do wish to live and their survival can be compared with a similar group of the general population In fact the degree of failure to meet their actuarial expectancy is one objective measure of results Palliation is not only difficult to define but it may be interpreted differently by both patients and surgeons Symptomatic relief is of major importance but what universally applicable measures can be used to make comparisons? Palliation can be judged but seldom measured

As might be expected the author has found local excision and fulguration to be a highly successful form of treatment against papillomas and low grade superficial carcinomas With papillary growths especially recurrences are quite common Many if not most of the recurrences are actually new tumors in other parts of the bladder (recurrences of a disease involving the whole bladder) At least half the patients with histologically benign papilloma have had at least one recurrence during the 5 years after the initial treatment Furthermore 15 to 20 per cent of the recurrences in this period have been histologically malignant Small superficial growths are more easily and successfully treated than large or deep neoplasms Accordingly the necessity for periodic cystoscopic examinations cannot be overemphasized as part of the therapeutic program Periodic examinations of the urinary sediment smears by the Papanicolaou technique can be a valuable adjunct in the follow up but the method does not adequately replace cystoscopy as was pointed out earlier and it has significant limitations in excluding the presence of neoplasms and particularly in excluding simple papillomas The author s usual practice is to make a cystoscopic examination about 8 weeks after the local therapy has been considered to be completed At this interval healing should be almost complete so that any neoplasms missed or inadequately covered can be detected promptly This procedure is as much a check on the therapeutic technique as on the neoplastic process In the absence of symptoms or signs suggesting recurrence cystoscopic examinations are advised approximately every 4 months for 5 years and at least annually thereafter

Passing to the other end of our scale of classification what have we to offer the patients with vesical cancers which have already

metastasized (stage D)? Cure in these circumstances is certainly very rare About 40 years ago A R Stevens performed an extensive segmental resection and at the same time removed an ipsilateral pelvic node containing metastatic carcinoma The patient survived more than 5 years without complaints although no detailed examination was permitted Such a case only proves the bare possibility but gives no indication of how frequently such a cure might be achieved A very rare patient with high grade and high stage cancer does survive 5 years without treatment and on rare occasions a treated patient lives 5 years after metastases are first manifest As indicated earlier the author s experience does not include a single authenticated example of a patient with histologically demonstrated metastases surviving for 5 years after treatment with radiation alone One of the early objectives of the author s surgical program was to determine whether or not a significant number of patients with nodal metastases could be cured by developing more extensive surgical excision Fourteen patients were found to have at least one preaortic or precaval node containing cancer None had evidence of more distal metastases and the growth in the pelvis seemed grossly removable by radical cystectomy or pelvic exenteration Bilateral radical node removal from the renal pedicles to the inguinal ligaments in conjunction with radical cystectomy failed to produce a single 5 year success in 14 attempts in fact all died within 2 years and most showed clear evidence of carcinomatosis distressingly promptly When the nodes on the common iliac vessels contained metastases or when many nodes anywhere contained cancer a 5 year survival was likewise not attained in approximately twenty cases but in 11 cases in which only one or two nodes within the pelvis (obturator region) were found to contain metastases 5 year survival was obtained in 2 In addition to these 2 1 patient had a cancerous pelvic node found in material from a limited nodal dissection during the time of the transition from simple to radical cystectomy, and he survives clinically free of cancer over 7 years later! Until further information to the contrary appears the author feels that a curative attempt by radical surgery is not worthwhile if more than one or two nodes in the pelvis contain metastases It is also his opinion that cystectomy solely for palliation is rarely if ever warranted in other words the price of the operation is too great when the prize of cure is impossible

Palliation

What then, may be done for those patients whose therapy must be palliative only Little can be done to deter the cancer itself Current hormonal and chemotherapeutic programs have failed in the author s experience Irradiation of painful metastatic areas is usually worthy of a trial As mentioned earlier irradiation of the bladder may temporarily reduce nonarterial bleeding but at some hazard of increasing irritability Permanent diversion of the urine may put the bladder nearly at rest and also provide protection against the ever impending obstruction infection of the kidneys However urinary diversion requires operation which in turn has significant risks complications and morbidity Bilateral chordotomy is highly successful in relieving pain but the operation is a strenuous one for debilitated patients Intrathecal alcohol has been a great pain reliever provided the pain is mediated through the cauda equina and provided the risks of motor and sensory impairment appear insignificant compared with the relief If one could accurately foresee the sequence and severity of coming events many palliatively preventive measures could be undertaken when the patient could rather easily withstand the treatment It has become more and more the author s practice to await the actual appearance of symptoms before instituting treatment because his accuracy in predicting the particular coming events has not been excellent and especially because the highly effective prophylactics are major undertakings

Of course urinary antiseptics and general analgesics and narcotics are of great value There has been so much teaching of sparing narcotics that many of these victims do not get what they need and deserve

Next to be considered is the middle or borderline group of neoplasms low grade carcinomas deeply invading muscle and high grade cancers invading muscle at any level even superficially Some successful results have been obtained by simple surgical treatment and by irradiation The question is What is the comparative incidence of success? The data to provide an answer are not directly at hand The use of the resectoscope against this group requires more than ordinary skill Some are best managed through a cystotomy The author s inclination is toward radical surgery especially if an initial attempt by simple surgery has failed

The subject of segmental resection has been reserved for special consideration In *highly selected* cases the method has been very valuable and symptomatically most advantageous (see Table 25 1) The major disadvantage is the understandable desire to use the method when the cancer is not well localized and when the growth is so located that an adequate margin is not likely to be obtained About three fourths of vesical neoplasms are either diffuse multiple or located within 2 or 3 cm of the trigone Segmental resection of the base is possible but in addition to being difficult technically an adequate margin is not often obtained Neoplasms localized in the upper half of the bladder although in the minority are usually suitable for removal by segmental resection If the carcinoma invades deep muscle or fat a pelvic node removal also seems indicated A carcinoma clearly limited to the right or left side of the bladder almost never metastasizes *only* to the pelvic nodes of the opposite side and accordingly an ipsilateral node dissection may be sufficient under the proper conditions

Finally it is all too clear that more failures than successes result from the treatment of the major vesical neoplasms The inherent nature of the neoplasm usually does more to determine the result than the treatment administered An essay of this inherent nature is the urologist s principal guide in selecting therapy Better techniques are needed in all directions but truly early diagnosis in the sense of predicting the appearance of cancer before it is actually present and an efficient preventive are most urgent

BIBLIOGRAPHY

Aschner P W The Pathology of Vesical Neoplasms J A M A 91 1697 1928

Barringer B S Twenty five Years of Radon Treatment of Cancer of the Bladder J A M A 135 616 1947

Editorial comment Cancer 1 155 1948

Jewett H J Carcinoma of the Bladder The Importance of Rectoabdominal Palpation under Anesthesia in the Selection of Cases for Total Cystectomy J Urol 49:34 1943

Jewett H J and Strong G H Infiltrating Carcinoma of the Bladder Relation of Depth of Penetration of the Bladder Wall to Incidence of Local Extension and Metastases J Urol 55 366 1946

Lee L W and Davis E Gross Urinary Hemorrhage A Symptom not a Disease J A M A 153 782 1953

Marshall V F A Comparison of Radiation and Surgery for Cancer of the Bladder J A M A 134 501 1947

Marshall V F The Relation of the Preoperative Estimate to the Pathologic Demonstration of the Extent of Vesical Neoplasms J Urol 68 714 1952

Marshall V F Whitmore W F Paquin A J et al *Bladder Tumors A Symposium* J B Lippincott Company Philadelphia 1956 also in Cancer 9 543 1956

McDonald D F and Lund R R The Role of the Urine in Vesical Neoplasm I Experimental Confirmation of the Urogenous Theory of Pathogenesis J Urol 71:560 1954

Roland S I and Marshall V F The Reliability of the Papanicolaou Technique When Cancer Cells Are Found in the Urine Surg Gynec & Obst 104 41 1957

Stevens A R Personal communication.

metastasized (stage D)? Cure in these circumstances is certainly very rare. About 40 years ago, A. R. Stevens performed an extensive segmental resection and at the same time removed an ipsilateral pelvic node containing metastatic carcinoma. The patient survived more than 5 years without complaints, although no detailed examination was permitted. Such a case only proves the bare possibility but gives no indication of how frequently such a cure might be achieved. A very rare patient with high grade and high stage cancer does survive 5 years without treatment and on rare occasions a treated patient lives 5 years after metastases are first manifest. As indicated earlier, the author's experience does not include a single authenticated example of a patient with histologically demonstrated metastases surviving for 5 years after treatment with radiation alone. One of the early objectives of the author's surgical program was to determine whether or not a significant number of patients with nodal metastases could be cured by developing more extensive surgical excision. Fourteen patients were found to have at least one preaortic or precaval node containing cancer. None had evidence of more distal metastases, and the growth in the pelvis seemed grossly removable by radical cystectomy or pelvic exenteration. Bilateral radical node removal from the renal pedicles to the inguinal ligaments in conjunction with radical cystectomy failed to produce a single 5 year success in 14 attempts; in fact, all died within 2 years and most showed clear evidence of carcinomatosis distressingly promptly. When the nodes on the common iliac vessels contained metastases or when many nodes anywhere contained cancer, a 5 year survival was likewise not attained in approximately twenty cases, but in 11 cases in which only one or two nodes within the pelvis (obturator region) were found to contain metastases, 5 year survival was obtained in 2. In addition to these 2, 1 patient had a cancerous pelvic node found in material from a limited nodal dissection during the time of the transition from simple to radical cystectomy, and he survives clinically free of cancer over 7 years later! Until further information to the contrary appears, the author feels that a curative attempt by radical surgery is not worthwhile if more than one or two nodes in the pelvis contain metastases. It is also his opinion that cystectomy solely for palliation is rarely, if ever, warranted; in other words, the price of the operation is too great when the prize of cure is impossible.

Palliation

What, then, may be done for those patients whose therapy must be palliative only? Little can be done to deter the cancer itself. Current hormonal and chemotherapeutic programs have failed in the author's experience. Irradiation of painful metastatic areas is usually worthy of a trial. As mentioned earlier, irradiation of the bladder may temporarily reduce nonarterial bleeding but at some hazard of increasing irritability. Permanent diversion of the urine may put the bladder nearly at rest and also provide protection against the ever impending obstruction infection of the kidneys. However, urinary diversion requires operation, which in turn has significant risks, complications and morbidity. Bilateral chordotomy is highly successful in relieving pain, but the operation is a strenuous one for debilitated patients. Intrathecal alcohol has been a great pain reliever provided the pain is mediated through the cauda equina and provided the risks of motor and sensory impairment appear insignificant compared with the relief. If one could accurately foresee the sequence and severity of coming events, many palliatively preventive measures could be undertaken when the patient could rather easily withstand the treatment. It has become more and more the author's practice to await the actual appearance of symptoms before instituting treatment, because his accuracy in predicting the particular coming events has not been excellent, and especially because the highly effective prophylactics are major undertakings.

Of course urinary antiseptics and general analgesics and narcotics are of great value There has been so much teaching of sparing narcotics that many of these victims do not get what they need and deserve

Next to be considered is the middle or borderline group of neoplasms low grade carcinomas deeply invading muscle and high grade cancers invading muscle at any level even superficially Some successful results have been obtained by simple surgical treatment and by irradiation The question is What is the comparative incidence of success? The data to provide an answer are not directly at hand The use of the resectoscope against this group requires more than ordinary skill Some are best managed through a cystotomy The author s inclination is toward radical surgery especially if an initial attempt by simple surgery has failed

The subject of segmental resection has been reserved for special consideration In *highly selected* cases the method has been very valuable and symptomatically most advantageous (see Table 25 1) The major disadvantage is the understandable desire to use the method when the cancer is not well localized and when the growth is so located that an adequate margin is not likely to be obtained About three fourths of vesical neoplasms are either diffuse multiple or located within 2 or 3 cm of the trigone Segmental resection of the base is possible but in addition to being difficult technically an adequate margin is not often obtained Neoplasms localized in the upper half of the bladder although in the minority are usually suitable for removal by segmental resection If the carcinoma invades deep muscle or fat a pelvic node removal also seems indicated A carcinoma clearly limited to the right or left side of the bladder almost never metastasizes *only* to the pelvic nodes of the opposite side and accordingly an ipsilateral node dissection may be sufficient under the proper conditions

Finally it is all too clear that more failures than successes result from the treatment of the major vesical neoplasms The inherent nature of the neoplasm usually does more to determine the result than the treatment administered An essay of this inherent nature is the urologist s principal guide in selecting therapy Better techniques are needed in all directions but truly early diagnosis in the sense of predicting the appearance of cancer before it is actually present and an efficient preventive are most urgent

BIBLIOGRAPHY

Aschner P W The Pathology of Vesical Neoplasms J A M A 91 1697 1928

Barringer B S Twenty five Years of Radon Treatment of Cancer of the Bladder J A M A 135 616 1947

Editorial comment Cancer 1 155 1948

Jewett H J Carcinoma of the Bladder The Importance of Rectoabdominal Palpation under Anesthesia in the Selection of Cases for Total Cystectomy J Urol 49 34 1943

Jewett H J and Strong G H Infiltrating Carcinoma of the Bladder Relation of Depth of Penetration of the Bladder Wall to Incidence of Local Extension and Metastases J Urol 55 366 1946

Lee L W and Davis E Gross Urinary Hemorrhage A Symptom not a Disease J A M A 153 782 1953

Marshall V F A Comparison of Radiation and Surgery for Cancer of the Bladder J A M A 134 501 1947

Marshall V F The Relation of the Preoperative Estimate to the Pathologic Demonstration of the Extent of Vesical Neoplasms J Urol 68 714 1952

Marshall V F Whitmore W F Paquin A J et al *Bladder Tumors A Symposium* J B Lippincott Company Philadelphia 1956 also in Cancer 9 543 1956

McDonald D F and Lund R R The Role of the Urine in Vesical Neoplasm I Experimental Confirmation of the Urogenous Theory of Pathogenesis J Urol 71 560 1954

Roland S I and Marshall V F The Reliability of the Papanicolaou Technique When Cancer Cells Are Found in the Urine Surg Gynec & Obst 104 41 1957

Stevens A R Personal communication

Part 7

Surgery of Special Systems

26

Neurosurgery

Bronson S. Ray

Nearly 20 per cent of the major operations on the central nervous system are performed on patients over the age of 60 years. A survey of neurosurgery in a recent year at The New York Hospital–Cornell Medical Center revealed that of the patients over 60 years 75 per cent were in the seventh decade, 18 per cent in the eighth, and 7 per cent in the ninth. Table 26.1 indicates the nature and relative frequency for that same year of the various conditions for which operations were performed in 95 cases.

The number of cases referred to in this sampling of a year's experience is too small to permit statistical deductions of the characteristics of the conditions encountered. Nevertheless certain generalizations may be made which approximate the results of larger studies of each disease and which exemplify the more important variants.

It hardly needs mentioning that the selection for study of a group of patients over 60 is somewhat arbitrary and that the majority of the diseases in this group may be encountered in persons of any age. Even so, the fact that many of the diseases are more prevalent after the age of 60 is a matter of importance diagnostically. Moreover, in older persons differential diagnosis and management of disease are both influenced by important factors such as the accumulated residual of previous injury and disease, the coexistence of other diseases, the regression of homeostatic mechanisms, and the inevitable degenerative changes in the central nervous system.

TABLE 26.1 FREQUENCY OF OPERATIONS FOR NEUROLOGIC CONDITIONS

Condition	Cases
Primary brain tumor	20
Metastatic brain tumor	7
Tic douloureux	15
Cord compression (metastatic)	7
Primary cord tumor	2
Subdural hematoma	7
Intractable pain (chordotomy and rhizotomy)	[illegible]
Lumbar disk	5
Cervical disk	2
Breast carcinoma (hypophysectomy)	9
Prostatic carcinoma (hypophysectomy)	2
Miscellaneous conditions	10

Pathologic changes in the aging central nervous system are most often attributed to arteriosclerosis but may be the result of many subtle influences. With age nerve cells exposed to pressure, mechanical trauma, anoxia, or other chemical and toxic insults show less ability to recover, and the brain as a whole shows less competence in developing new patterns of function. The speed of learning declines with the years, though in many persons greater speed in evaluating a new experience and in correlating it with existing knowledge more than compensates for this.

The changes in the neuroskeletal system as evidenced by the gradual slowing and weakening of reflexes and general body activity are obvious. While the decreased functional capacity may be affected by alterations in muscular tissue itself, a large part is attributable to structural and no doubt to biochemical changes in the nervous system. Atrophy of the Purkinje cells in the cerebellum, which are concerned with tone

and coordination of skeletal muscles may well play a role in the increasing weakness and diminishing coordination of old persons Senile tremors and the more specific Parkinson s disease cannot be related definitely to degeneration in a specific area in the brain though the latter malady is often ascribed to loss of cells in the substantia nigra and the globus pallidus

Diminution in the size and weight of the cerebrum is attributed to a generalized atrophy especially in the frontal and occipital lobes and more particularly to the disappearance of cells in some of the layers of the cortex Associated cellular changes include pigmentation and fat infiltration of ganglion cells degeneration of axones and hyperplasia of neuroglia cells

Degenerative changes similar to those in the brain also occur in the aging spinal cord that is loss of ganglion cells, pigmentation fat infiltration and degeneration of motor axones On the sensory side there is a significant decrease in the myelinated fibers of the dorsal roots which is believed to be the result of atrophy and loss of cells in the spinal ganglia These changes are probably responsible for the reduction in cutaneous and protopathic sensibilities in the aged The sense of pain seems to be least affected

The pituitary gland (neurohypophysis) which may correctly be regarded as a part of the central nervous system shows certain structural changes with aging But from the standpoint of function the gland shows a remarkable degree of stability as has been learned through experience when hypophysectomy is performed therapeutically in older persons with malignant disease There is no definite evidence at present that the cessation of gonadal and the lessening of thyroid function that occur with advancing years are the result of decreased production of trophic hormones by the pituitary Were pituitary function to diminish significantly with age this might be a blessing in disguise since the loss of diabetogenic factor (or factors) of pituitary secretion might ameliorate diabetes mellitus which so commonly occurs as the secretory cells of the pancreas degenerate

PRIMARY BRAIN TUMORS

Old age is no guarantee against the development of brain tumors In a large unselected group of people older than 61 Monroe found an incidence of 0 2 per cent of primary intracranial neoplasms But Rupp and his coworkers, in a more recent 10 year survey at the Philadelphia General Hospital encountered a brain tumor in 1 out of each 150 necropsies (0 7 per cent) in persons over 60 In the author s experience approximately twenty per cent of verified brain tumors occur in patients over 60 years of age Of this group of tumors about two thirds developed in patients between the ages of 60 and 70 nearly a third between the ages of 70 and 80, and a few after 80

Age has an influence on the frequency with which some types of intracranial tumors are encountered certain ones found in the early years of life not being expected in the later years For example medulloblastoma of the cerebellum so common among the brain tumors of childhood is unheard of after the age of 60 In fact primary tumors of the cerebellum of any kind are rare after 60 yet they constitute the major incidence in childhood The commonest brain tumor of adulthood including old age is the malignant glioblastoma (grade IV glioma) of the cerebrum, and it is rarely found in childhood On the other hand craniopharyngiomas which are of congenital origin and often in evidence in early life may surprisingly remain quiescent and first manifest their presence as late as the age of 70

Perhaps the principal reason for giving attention to the problem of brain tumor in older patients is that in no system of the body other than the central nervous system is the physician so seriously confronted with the difficulties of diagnosis The cardinal signs of brain tumor are about the same at all ages but a number of factors contribute

to failure or uncertainty in the diagnosis in an elderly patient Chief among these are the prevalence of systemic vascular disease and the acceptance by both physicians and relatives that a certain degree of neurologic and psychiatric disorder must be expected with age Not only is there often delay in *admitting the patient to the hospital* but once there the usual procedures employed for diagnosing a brain tumor are omitted or deliberately avoided because of the advanced stage of the disease coexisting diseases or presumed risks attending ancillary tests

Of the 20 patients with brain tumor included in this study 14 had involvement of the cerebral hemispheres 10 with gliomas and 4 with meningiomas Eight of the gliomas were of the most malignant variety while two were less so one of these (astrocytoma grade I) perhaps having been surgically cured The other six tumors were acoustic neurinomas (three) pituitary adenomas (two) and craniopharyngioma (one)

In the patients with *gliomas* the longest duration of symptoms was 6 months and the shortest 10 days prior to operation the average was 2½ months All but 2 showed easily recognizable changes in mood behavior memory or judgment Headache of mild to moderate degree was present in all and 6 of the 10 had papilledema Convulsions had occurred in 2 6 had some degree of motor palsy and 3 had impairment of speech (aphasia) Roentgenograms of the skull demonstrated a shift of the pineal gland in 2

Electroencephalography gave a strong clue to the presence and relative location of the tumors in 5 In one of these the lateralization was on the wrong side and in another in the pole of the hemisphere opposite to that in which the tumor existed in 3 the pattern though abnormal was diffuse and not specific for tumor Spinal fluid examination made in 5 cases showed an elevation of total protein content from 75 to 175 mg per cent in 4 and a normal protein content in 1 Pleocytosis of 100 cells was present in the spinal fluid of 1 of the patients with glioblastoma which was found to have invaded the ventricles Cerebral angiography gave evidence of a space occupying lesion in 8 of the 10 cases but in only 4 was there tumor staining by the injected dye In all 9 patients in whom air studies either by the spinal or the ventricular route were performed as an *immediate preliminary to a planned craniotomy* the procedure provided unequivocal evidence of the presence and location of a tumor

Differential Diagnosis

Certain features in the development of symptoms may be of assistance in differentiating brain tumor of the cerebrum from cerebral vascular accidents The relative acuteness of onset and the speedy attainment of the maximum of neurologic changes in vascular accidents is contrary to the more subtle onset and progressive changes usually observed in patients with tumors But the occasional abrupt onset of major neurologic symptoms from a brain tumor or the progressive palsy accompanying a propagating thrombosis or increasing edema of a cerebral vascular accident can make differentiation uncertain Thrombosis of the internal carotid at the bifurcation of the common carotid artery is particularly prone to cause headache a succession of minor strokes and a resulting gradual increase in paralysis symptoms which mimic those of brain tumor

Unfortunately localized abnormalities in the electroencephalogram often do not permit a distinction between the changes caused by a vascular accident and those caused by a neoplasm When confronted with difficulty in diagnosis one has recourse to cerebral angiography or intracranial air studies either of which have a high degree of efficiency and safety under present methods of performance These tests become unsafe principally when inexpertly performed or when preparations have not been made to follow them by craniotomy if a tumor is demonstrated

Survival of a patient with a malignant glioma of the brain is limited on the average

to 10 or 12 months, though the occasional patient may live longer Postoperative radiation therapy, though unpredictable in its effect sometimes appears to have benefit It is the author s belief that it is usually appropriate to attempt improvement or arrest of the disease by surgery even if it fails or the effect is temporary The effort is sometimes well repaid by the gratitude of a patient and his relatives for just a temporary surcease of symptoms In addition and most important there is the not uncommon experience of encountering a more benign or curable tumor when a malignant one was feared

Meningiomas

In this series of cases there were four meningiomas and although this number is small, the relative incidence is much the same as that found in a larger study The locations of the four were sphenoid ridge olfactory groove convexity of the parietal region and parasagittal in the frontal region Meningiomas can occur anywhere over the surface of the brain but the ones encountered here are representative of the commonest locations

The relatively slow growth of meningiomas and the gradual displacement of the brain accounts for the paucity or gradual development of symptoms and signs that may exist for some time often for many months Convulsions are common particularly with those tumors that encroach on the convexity of the parietal lobes The point is sometimes brought up in differential diagnosis between meningioma and glioma that the one has a protracted course whereas the other has a more precipitous one But serious mistakes occur when the argument is made that the rapid development of symptoms necessarily indicates a malignant glioma or some other tumor having an unfavorable prognosis with operation Not infrequently the intracranial mechanisms which have accommodated a long time for the presence of a meningioma will quickly cease to do so and fulminating symptoms will result

Assistance in diagnosis of meningiomas may be provided by changes in roentgenograms of the skull, such as calcification in the tumor hyperostosis or erosion of the overlying bone or increased markings of the grooves of the meningeal arteries especially those of the middle meningeal artery As a group meningiomas more consistently produce a higher degree of protein in the cerebrospinal fluid than do other supratentorial tumors

These tumors are essentially benign tend to displace rather than invade the brain and are often surgically curable Failure to cure results from their growth into inaccessible places or their incorporation of structures such as the internal carotid or middle cerebral arteries which precludes safe total removal The inordinate size and vascularity which unrecognized or untreated meningiomas may attain adds to the surgical risk One of the four patients in this series died in the immediate postoperative period

Acoustic Neurinomas

Acoustic neurinomas (three cases in the series) are benign encapsulated tumors that arise from the acoustic nerve and produce a group of symptoms referred to as the *cerebellopontile angle syndrome* Unilateral tinnitus and gradual loss of hearing over a period of many months or years are a prerequisite to the diagnosis Poor balance and a feeling of unsteadiness result from paralysis of the vestibular portion of the nerve and compression of the vestibular nucleus in the adjacent brain stem but true vertigo particularly in paroxysms is not a symptom As the tumor grows adjacent facial and trigeminal nerves become affected and in the advanced cases characteristically there are homolateral motor and sensory changes in the face less common are hoarseness and difficulty in swallowing from involvement of the vagus nerve Papilledema also occurs when the tumor attains sufficient size to block the cerebrospinal fluid pathways

When the syndrome is fully developed there should be little difficulty in diagnosis but the significance of early subtle symptoms

of impairment in hearing and unsteadiness of gait especially in older persons is easily overlooked or regarded as a part of aging Several tests can be of great value The absence of vestibular function on the side of the deafness tested by irrigating the ear canal with cold water and the presence of an elevated total protein content of the cerebrospinal fluid are nearly pathognomonic for the condition In approximately half the cases erosion of the petrous bone at the porus acusticus can be demonstrated by roentgenograms

Early diagnosis is important since these tumors though benign are fatal if permitted to develop fully and the risks of operation are materially increased when numerous palsies and papilledema have already developed Occasionally when the diagnosis is made early and symptoms are few there is reticence in subjecting the patient to surgery but unless there are other more important factors in the patient s physical state any needless delay in the operation is a serious mistake The tendency of surgeons in recent years to perform radical removal of the tumors has doubtless led to some increase in mortality from the operation But in an older patient an intracapsular excision of the tumor will often suffice to prevent important regrowth of the tumor within his life span and is attended by much less risk Of the three patients of this series one had a radical extirpation of the tumor and the other two had intracapsular excisions all survived

Tumors in the Region of the Sella Turcica

The common tumors that occur in or about the sella turcica are pituitary adenomas craniopharyngiomas and meningiomas of the tuberculum sellae They characteristically produce defects in the visual fields (especially bitemporal hemianopsia) loss of visual acuity and primary optic atrophy if untreated they are likely to lead to blindness They also tend to suppress pituitary activity thus causing hypothyroid and hypoadrenal function and occasionally may become large enough to encroach on adjacent regions of the brain

Visual changes like loss of hearing are commonly accepted as a matter of aging and tumors of the sellar region are not as a rule regarded as one of the causes The most important method of differentiation lies in accurate perimetry which cannot adequately be accomplished by gross tests of finger movements Difficulties are increased in the presence of cataracts glaucoma and arteriosclerotic degeneration of the optic nerves Roentgenograms of the skull may simplify diagnosis but are usually not resorted to unless the suspicion of a tumor is raised first

The craniopharyngiomas being congenital are expected to manifest their presence earlier in life but the fact that they may produce their first symptoms late in life is demonstrated by a case in which bitemporal hemianopsia and impaired visual acuity developed at the age of 70 Though there is often calcification in the tumor visible on roentgenograms there was none in this case Vision was restored nearly to normal by drainage of the cyst and partial removal of its wall

Of the three types of pituitary adenoma the basophilic adenoma (of Cushing s syndrome) and the eosinophilic adenoma (of acromegaly) are not encountered in older age while the chromophobe adenoma may occur in patients in their sixties and even in their seventies In addition to the accompanying visual changes the reduction in thyroid and adrenal functions resulting from impaired production of trophic hormones in the pituitary may cause serious debilitation In most cases of pituitary adenoma the sella turcica becomes enlarged (ballooned) but this may not always occur if the tumor becomes extrasellar furthermore other conditions particularly in the aged can alter the appearance of the sella

The appropriate treatment of pituitary tumors sometimes gives rise to debate in view of the interest many have in trying the effects of radiation therapy There is no doubt that

sometimes chromophobe adenomas respond to irradiation and become reduced in size, and it is appropriate to employ such treatment on a trial basis if vision has not already been too seriously threatened But when vision has been significantly reduced, it is the author's opinion that it is inappropriate to risk further visual loss, which may become irreversible while some weeks are employed in a trial period of irradiation Some have inferred that better results can be expected by the use of present day higher-voltage machines but the standard low voltage therapy machine can deliver the same tumor dosage Too often it is assumed, also that whatever visual loss persists on completion of radiation therapy is irrecoverable, yet experience has shown that sometimes an unexpected degree of vision returns with surgical removal of the adenoma In addition to these objections to the reliance on radiation treatment there is the fact that sometimes the diagnosis cannot be made with certainty and that in older patients meningiomas of the tuberculum sellae may be indistinguishable from other tumors without surgical exploration Meningiomas in this region are not benefited by irradiation

The morbidity and mortality of operations on the common tumors of the sella turcica are low and the preservation or restoration of vision well worth any risks which are now relatively small the result in large part of modern surgical techniques and the readily available substitution therapy for thyroid and adrenal insufficiency

METASTATIC BRAIN TUMORS

When symptoms and signs of intracranial tumor develop in persons over 60 consideration must always be given to the possibility of metastasis even though routine investigation fails to reveal the existence of neoplastic disease elsewhere The commonest metastatic tumors of the brain have their origins from primary neoplasms of the lung breast gastrointestinal tract and kidney and less frequently from the urinary bladder, prostate, lymphatic system, and melanotic lesions of the skin The prevalence of breast cancer in the female and lung cancer in the male and their frequent metastases to the brain emphasize the need for recognizing the possibilities

Brain metastases from bronchogenic carcinoma are more frequent than are those from mammary carcinoma in a ratio of nearly 3 1, but as a rule the latter are more suitable for surgical removal This accounts in large part for there having been in this series of surgical cases four of intracranial metastasis from breast cancer and but two from lung cancer, a single case was of renal origin

The clinical manifestations of a single metastatic tumor are not usually distinguishable from those produced by a primary brain tumor difficulties in diagnosis arise when there are multiple metastases The duration of symptoms in most cases is relatively short in part as a result of edema of the surrounding brain which frequently accompanies the lesion in greater degree than is seen with primary tumors Since primary tumors of the cerebellum occur so infrequently in the aged the development of cerebellar signs in a patient over 60 arouses strong suspicion of a metastatic tumor A particularly difficult diagnostic problem is presented by meningeal carcinomatosis in which there is miliary invasion of the meninges causing increased intracranial pressure and increasing stupor without localizing neurologic signs

Spinal fluid examination may be particularly useful in establishing a diagnosis if tumor cells are found in a centrifuged specimen or a reduced sugar content identified in those cases with meningeal invasion The presence of two or more lesions in the brain can sometimes be demonstrated by angiography since metastatic tumors frequently show staining with the dye injected for the test

Any decision regarding surgical treatment of metastatic brain tumor must take several factors into consideration and commands one's best clinical judgment There is no

place for excessive optimism about what can be accomplished by any palliative surgery in metastatic disease but those who would deny any merit to removal of a metastasis in the brain overlook the gratifying results that sometimes follow Though they represent the minority there are many examples of patients surviving for a number of years after excision of a single intracranial metastasis before succumbing to the original neoplastic disease Even a decompression for relief of increased intracranial pressure occasionally has value and makes possible the useful administration of radiation therapy thereafter A problem that calls for special consideration is the one in which the patient believed to have been possibly cured of a malignant tumor develops the symptoms and signs of a brain tumor Withholding a craniotomy on the assumption that the malignant disease exists after all and has now metastasized to the brain may deny the patient a chance for relief or possible cure of a primary brain tumor

TIC DOULOUREUX

Tic douloureux is a disease predominantly of older age and includes both trigeminal and glossopharyngeal neuralgia occurring in a ratio of about 10 1 It is believed to be the only true neuralgia and its etiology is not established

In trigeminal neuralgia the pain occurs in some part or occasionally in all parts of the face and mouth supplied by the trigeminal nerve Since there are no objective findings in the disease except the transient expression of anguish during pain the diagnosis must be made on the basis of the history The sudden paroxysms have three characteristics necessary for diagnosis (1) There is severe shocklike or stabbing pain of short duration rarely exceeding 60 seconds in a single paroxysm (2) the pain is limited strictly to some part of the distribution of the trigeminal nerve (3) it is induced by stimulation of trigger zones lying within the area of distribution of the nerve

The disease infrequently involves both sides of the face (about 2 per cent of cases) and never both sides at the same time Characteristically the pain occurs in episodes lasting some weeks or months with intervals of spontaneous remission that also may last for months But recurrences always appear and over a period of years the pain usually tends to recur in greater severity with shorter remissions

Though many forms of treatment have been proposed over the years since the disease was described by Fothergill in 1776 none assures permanent and certain relief of pain except destruction of the nerve at the gasserian ganglion or the fibers proximal to the ganglion Since interruption of the nerve necessary for cure imposes numbness in exchange for pain in the face it is best that the patient not be urged to have the operation until he is satisfied that the pain untreated inevitably returns and that lesser measures of palliation are ineffectual for complete relief

Of the lesser measures of treatment the ones most commonly employed are injection of alcohol into the maxillary or mandibular divisions at the sites of emergence from the skull and the injection or avulsion of certain peripheral branches of the supraorbital infraorbital and mental nerves where they leave their foramina For example trigeminal neuralgia located in the forehead is relieved by interruption of the supraorbital nerve in the upper lip by interruption of the infraorbital nerve and in the entire mandible by interruption (injection) of the mandibular division While these procedures may have their place the objection to them is that the effect is always temporary and repetitions of the procedures become progressively less effective Injection of alcohol into nerves is not without occasional local complications nor is it a comfortable method since it must be done with the patient awake The advantages claimed are that operation on the nerve root can be delayed to a more propitious time and that the patient is appraised of what he may expect in the way of numb-

ness if he comes eventually to a more permanent operation on the nerve root The fallacies inherent in this reasoning are that after delaying procedures the patient may be less rather than more safe for the definitive operation and that he may be misled into believing that the anesthesia resulting from the operation will be the same as the temporary numbness he experienced with the lesser procedure

In an effort to avoid an operation and yet obtain permanent relief, injection of various destructive agents into the gasserian ganglion via the foramen ovale has been recommended The principal objection is that the procedure is relatively blind depending as it does on the accurate placement of the agent at a depth In addition no selectivity is possible as is the case with section of the nerve root

In recent years interest has developed in an operation for trigeminal neuralgia designated as *decompression of the root* It has evolved into a variety of surgical exposures of the root and ganglion all designed somehow to alter the function of the nerve without actually dividing it This empiric method has been found to give relief of pain in about half the patients on whom it is performed There is disagreement over how it relieves pain but probably the common factor in the various operations is a degree of trauma to the sensory fibers in the root

Surgical division of the sensory root can be performed by way of an extradural approach in the temporal region or an intradural approach in the cerebellopontile angle There may be circumstances that make one more appropriate than the other in an individual case but for the most part the choice is arbitrary most surgeons favoring the temporal operation Unless the neuralgia involves the forehead and eye the effort is *usually made to preserve those fibers of the* root which supply that area the principal reason being to conserve corneal sensation The motor division of the nerve can usually be preserved but if circumstances require preservation of the motor root it can be accomplished with greater assurance by the posterior rather than by the temporal approach

Following section of the sensory root the possible complication of greatest concern is that of unbearable paresthesias in the face All patients after operation experience a variety of sensations in the anesthetic region but a few perhaps 5 per cent always the more aged, become distressed and increasingly preoccupied with the sensations for which no relief exists A small per cent (5 to 7) develop a transient facial paralysis which always subsides though the recovery may sometimes fall short of being complete The mortality of the operation should not exceed 1 per cent in the author s experience it is a fraction of 1 per cent

Glossopharyngeal neuralgia is comparable in every respect to trigeminal neuralgia except in its location which is at the base of the tongue and in the region of the tonsillar fossa occasionally extending into the ear There is no satisfactory treatment short of section of the glossopharyngeal nerve intracranially Fortunately there are no neurologic defects recognizable by the patient after interruption of this nerve and the results are eminently satisfactory

CORD TUMORS

Under the general heading of cord tumors are included not only the primary intramedullary and extramedullary tumors but the extradural tumors in the spinal canal the majority of which are metastatic

Primary intramedullary tumors are for the most part gliomas with astrocytomas and ependymomas predominating It is unusual for these tumors to occur in older age but the common primary extramedullary tumors the meningioma and the neurinoma have a relatively high incidence after the age of 60 Of the two primary cord tumors listed in this study one was a meningioma in the upper thoracic region and the other a neurinoma in the cervical region arising from the

sixth cervical nerve root These tumors are benign and can usually be completely excised

More often the cause of cord compression and progressive myelitis in the older patient is a metastatic tumor in the extradural space of the spinal canal It is uncommon for such tumors to extend through the dura to invade the intradural space or the cord itself and direct metastasis to the cord is exceedingly rare

Of the seven cases of cord compression from metastatic tumors encountered in this study one was from Hodgkin s disease three from breast cancer two from lung cancer and one from prostatic cancer A larger series would include tumors of various other origins since the vertebrae and adjacent tissues have a dense venous and lymphatic structure that makes them especially vulnerable to metastatic implants

Reticular tumors including Hodgkin s lymphosarcoma and other lymphomas more often occur in early and middle life but are not rare in older ages Usually there is some evidence of the existence of the disease prior to the development of spinal metastasis or extension Occasionally the diagnosis is made when the tumor is first encountered in a spinal operation and this is particularly so with lymphosarcoma Indeed the occasional cases of lymphosarcoma in the spinal canal treated locally by surgery and radiation have shown many years survival without evidence of the disease

Neoplasms of the breast lung and prostate are recognized as having a predilection for metastasis to the spine A patient known to have one of these primary malignancies who develops pain along the spine is a suspect though some time may then pass before metastasis in the bone can be demonstrated by roentgenography or before cord compression develops Pain localized to some part of the back or radiating in radial distribution is predominantly the early symptom of an intraspinal neoplasm either primary or metastatic and may continue to be a difficult problem in management after surgery Lesions below the first lumbar vertebra come to involve the cauda equina thereby producing sensory loss flaccid type of motor paralysis and areflexia in the lower limbs accompanied by loss of bladder control Lesions above this level affect the spinal cord with correspondingly higher levels of sensory loss Babinski signs a spastic type of paralysis and hyperreflexia below the level of the lesion As a rule the more benign tumors cause a more insidious development of symptoms whereas the more malignant ones at times result in extremely rapid paralysis The more rapid development of myelitis is likely to result from the combined effects of compression of the cord and ischemia due to occlusion of the nutrient arteries by tumor in the vertebral foramina through which the vessels pass

In the absence of knowledge of existing malignant disease the exact nature of an intraspinal tumor cannot usually be determined without operation nor is it necessary to do so Roentgenograms of the spine sometimes show thinning of pedicles or laminae or enlargement of intervertebral foramina from the presence of benign slowly growing tumors Metastatic tumors are looked for particularly in destructive erosion of the pedicles and vertebral bodies but since there may be other such lesions in the spine it may not be possible in the presence of an incomplete myelitis to determine which of several destructive lesions in the spine is the offender Spinal fluid examination for elevated protein content and manometric studies for block of the spinal canal are useful adjuncts in the examination

Myelography is of particular advantage since it not only verifies the presence of a suspected tumor but also identifies the location Because the clinical findings may not always reliably establish the vertebral level of the cord compression particularly in incomplete myelitis it is advisable to employ myelography in most cases before proceeding with surgery The exceptions exist in those cases in which the level of the myelitis indicated by the clinical findings corresponds

convincingly to a destructive lesion seen on the roentgenogram of the spine It is highly important to recognize that lumbar puncture for removal of spinal fluid or for myelography is attended by a distinct risk of worsening the myelitis even within a few hours thereafter Therefore lumbar puncture in these cases cannot safely be employed unless there is a plan for a surgical operation to follow or at least the means for prompt availability of surgical treatment if it becomes necessary

In the management of intraspinal tumors surgery has first choice with certain exceptions The degree of recovery of function after surgical removal of a primary neoplasm or decompression of the cord by laminectomy and partial removal of a metastatic tumor is largely dependent on the degree and duration of the myelitis before operation If complete myelitis has existed for weeks or more little return of function can be hoped for from decompression of the cord Even several hours delay after complete myelitis has occurred can make a difference in recovery If the problem is reliably one of metastatic tumor causing pain alone or producing incomplete cord compression of minor degree radiation therapy may be used to advantage This method in conjunction with the administration of nitrogen mustard intravenously is especially applicable in the treatment of the reticular tumors (Hodgkin s disease and other lymphomas) But it is imperative that strict attention be given to the neurologic signs during a trial period of irradiation and that surgery be resorted to without delay if neurologic signs show progression

If the possibilities for giving radiation therapy have not been exhausted before operation it is usually appropriate to give the treatment afterward even when the susceptibility of the tumor is uncertain Persistent pain from an incompletely removed tumor can often be prevented or minimized by section of several sensory nerve roots in the region at the time of the operation Chordotomy is infrequently used for relief of persistent pain in these cases, since in many cases the lesions are in the upper thoracic region and high cervical chordotomy is unsuitable

In evaluating the merits of surgical treatment of intraspinal metastatic disease the limitations of the procedure are evident But the purpose of the operation is to preserve or restore neurologic function if possible which it does in many patients whose lot is thereby made easier in their declining days

INTRACTABLE PAIN

In addition to the problems that arise in older persons from metastases to the spinal canal there are fairly frequent and urgent problems of relief of unrelenting pain from incurable cancer A physician who assumes the responsibility for care of patients with cancer should be aware of the possibilities for relief of pain by surgical methods and avoid if possible the unfortunate aspects of the patient s addiction to opiates

When confronted with the possible need for surgical relief of pain it is helpful to have some knowledge of the natural history of the particular disease the better to determine the appropriateness of surgery For example, it is not likely that division of nerves or spinal tracts will be helpful for control of pain of a widely spread and a rapidly progressing bronchogenic carcinoma or in any patient who is expected to live but a few weeks But the several common cancers of the pelvic organs such as those of the rectosigmoid the cervix and the bladder are prone to invade local tissues producing pain long before they spread more widely to threaten the patient s life There are also many neoplasms about the head and neck region that are exceedingly painful and yet their growth and extension may be kept in check for many months or years

The type of surgical interruption of pain pathways to be used is dependent largely on the location of the pain In the head and neck regions rhizotomy of the appropriate sensory roots is employed This may require

division of but one nerve such as the trigeminal if the lesion arises from the maxilla whereas additional nerves such as cervical roots and sometimes other sensory cranial nerves must be divided if the lesion occupies the mandible in the region where there is overlap of sensory innervation In a survey of 100 cases of painful malignancies about the head and neck treated by rhizotomy at The New York Hospital the results were judged to be satisfactory in at least 75 per cent of the cases and approximately one third of the cases were of patients over the age of 60

For painful malignancies in the lower extremities pelvis or trunk below the mid thorax the most appropriate surgical treatment is section of the pain fibers in the spinothalamic tracts of the cord (chordotomy) at the upper thoracic level Usually it is necessary to perform the section on each side of the cord since it is unlikely that the lesion producing the pain is on but one side or that it will long remain there Ideally this operation results in loss of pain (and temperature) perception below the midthorax preserving other forms of sensation and good motility in the lower limbs There may however be some impairment of sphincter control and weakness in the legs following the operation but these can usually be expected to improve with time particularly if the patient s general strength permits him to get out of bed and exercise The results of thoracic chordotomy are estimated to be satisfactory in approximately 70 per cent of cases and any mortality following the operation is mostly attributable to factors other than the operation itself

Painful cancerous lesions of the upper thorax and shoulder region such as mammary cancer which invades the brachial plexus present a more difficult problem in surgical management Section of the spinothalamic tract in the high cervical region is somewhat more hazardous than thoracic chordotomy and cannot be relied on always to produce a level of analgesia high enough to include all the painful area in which case it must be supplemented by rhizotomy of some of the sensory cervical roots

Mention should be made of the general uselessness of nerve blocks for relief of chronic pain of cancer the possible exceptions being alcohol injection into branches of the trigeminal nerve and injection of alcohol in the sacral subarachnoid space The latter procedure is applicable in cases of pain limited strictly to the perineum In these cases the injection of 1 cc of absolute alcohol in a manner to bathe the sacral nerve roots will produce anesthesia in the limited area supplied by these nerves Unfortunately loss or at least temporary impairment of sphincter control also occurs though this may at times be an acceptable imposition in exchange for relief of pain

SUBDURAL HEMATOMA

In elderly persons subdural hematoma is a relatively common condition due in part to their frequent falling and in part to greater vulnerability to trauma of the cerebral veins bridging the subdural space between the cerebrum and the dural sinuses The symptoms are so variable and subtle that the condition easily goes unrecognized or is mistaken for cerebral degeneration cerebral vascular accident brain tumor (particularly metastasis) and other conditions Although early diagnosis of the condition may be difficult on the basis of symptoms and physical examination it is imperative since rapid decline or sudden death are rather frequent in the course of the illness and also because too long a delay in treatment is attended by failure

With the exception of occasional spontaneous hemorrhage in the subdural space in those receiving anticoagulant therapy subdural hematomas occur mostly as a result of head injury These facts should aid in the recognition of the condition but the injury is often so trivial that it is disregarded or forgotten or impossible for the patient to recall once he begins to develop mental changes as a result of the hematoma Indeed

such patients too confused to give a reliable history, may actually give a misleading one Time and again one who is unable to cite any related injury till after he is relieved of the hematoma will then clearly recall that his symptoms began after bumping his head on a shelf or car door It is axiomatic that lesser head injuries are much more often the cause of the subdural hematoma than are more serious injuries

If a reliable history is available the typical sequence following the injury is the persistence and gradual increase in headache with the subtle development of increasing drowsiness and diminished intellectual activity, initiative memory and orientation It is important to recognize that the absence of persistent symptoms after a head injury should exclude it as a cause of any symptoms arousing suspicion of a subdural hematoma developing at some later date The headache is variable in degree but has the quality of persistence, is often lateralized or predominant on the side of the hematoma and is made worse by jolting and changes in position Hemiparesis and aphasia are not uncommon developments Striking variations in a patient's symptoms especially in the degree of alertness are likely to lead to a sense of false security over his condition if he seems to have improved spontaneously after a period of more alarming symptoms Homonymous hemianopsia and convulsive seizures though unusual accompaniments, do occur and they should not be regarded as evidence against the diagnosis of subdural hematoma There may be pupillary changes particularly a large pupil on the side of the lesion, but anisocoria is of limited help in the diagnosis except as possible evidence of intracranial disease

Papilledema and measured increased intracranial pressure somewhat paradoxically are absent in about three fourths of the cases but at least 60 per cent show degrees of xanthochromia cellular reaction and increased total protein in the spinal fluid Roentgenograms of the skull may disclose a fracture or lateral displacement of a calcified pineal gland Electroencephalography is of limited diagnostic aid Cerebral angiography in most cases can be relied upon to identify or rule out the presence of a subdural hematoma by demonstrating the presence or absence of a space between the cerebrum and the skull However there is some reticence in employing angiography in older patients in critical condition

The safest and most reliable way to identify the lesion is by exploratory trephinings of the skull Furthermore the same trephined openings may be used to drain liquid hematomas and effect a cure Because of the possible bilaterality of the hematoma since the subdural spaces over the cerebral hemispheres are confluent beneath the falx it is always advisable to investigate both sides When more solid clots exist or expected improvement fails to materialize or persist after drainage through a trephined opening a larger craniotomy and sometimes removal of bone for decompression are necessary

The results of surgery are expected to be good unless it is performed too late There is a relatively high percentage of mortality in neglected cases owing principally to hemorrhage and softening in the midbrain Unfortunately this complication sometimes occurs after release of the hematoma The importance of early diagnosis and treatment cannot be overemphasized, and there should be no hesitation in resorting to exploratory trephinings and no regret if they are performed without disclosing a suspected hematoma

INTERVERTEBRAL DISK PATHOLOGY

Symptoms from injury to intervertebral disks are encountered mostly in persons of middle life The incidence declines rapidly in older ages owing to the fact that the nucleus pulposus degenerates and there is less possibility of protrusion of this material to cause symptoms Nevertheless a few patients over the age of 60 may retain the nucleus in suf

ficient amount for it to be a source of trouble The resulting characteristic symptoms are those of sciatica in the lower limbs or of radiculitis in the upper limbs since the sites of rupture of the disk and protrusion of the nucleus pulposus are nearly wholly restricted to the lower two or three lumbar and to the fifth and sixth cervical disks In such cases conservative treatment consisting particularly in limiting activity is always preferred initially but persistent pain or the development of palsies in muscles supplied by the implicated nerve root calls for removal of the nucleus pulposus and decompression of the nerve root just as in the younger patient The question of combining fusion of the spine with the operation is less pressing than it sometimes is in younger persons since most surgeons regard fusion operations as inappropriate after the age of 60

More often the cause of radiculitis in the upper or lower limbs in older persons is compressive irritation of a nerve root by hypertrophic changes that distort the root or narrow the foramen through which it leaves the spinal canal These hypertrophic changes are in the nature of calcified fibrous spurs or ridges at the margins of intervertebral disks and represent the degenerative changes of aging and no doubt often the sites of disk injuries in years past In the presence of an unyielding protuberance of this nature an adjacent nerve root may easily become irritated with movements of the neck or back Occasionally surgical decompression of the nerve root may be called for particularly in the cervical region but results on the whole are less satisfactory than might be hoped for

A syndrome which has come to be recognized with greater frequency in recent years is a progressive cervical myelitis due to a calcified ridge at the level of a cervical disk which compresses and distorts the cord anteriorally thus making it vulnerable to the effects of additional compression with movements of the neck The condition is more often a painless one in which degrees of numbness weakness and atrophy develop in the upper limbs while stiffness weakness unsteadiness and abnormal reflexes develop in the lower limbs In more advanced cases the clinical picture is one of distinct myelitis of the cervical cord with accompanying sensory level and impairment of sphincter control The condition particularly mimics amyotrophic lateral sclerosis lateral column disease and other degenerative disease of the cord seen in older persons The diagnosis can be suspected by the nature of the neurologic changes and the existence of hypertrophic alterations in the cervical spine on roentgenograms By spinal puncture it may be possible to demonstrate a block of the spinal canal by the Queckenstedt test when the neck is in hyperflexion or extension Myelography in these cases will clearly show the offending ridge and sometimes demonstrate the existence of an additional one or two ridges of equal importance The treatment consists of various surgical maneuvers designed to alleviate cord compression and on the whole the results are good in terms of arrest of the progressive myelitis and sometimes improvement in the preoperative symptoms

METASTATIC CANCER OF THE BREAST AND PROSTATE TREATED BY HYPOPHYSECTOMY

It has been amply demonstrated that alteration of the endocrines in the body can have a salutary effect in some patients with cancer of the breast or prostate These two neoplasms seem to have much in common in the characteristics of their growth and their relation to the endocrines Temporary remissions of the disease have sometimes followed ablation of the gonads and the adrenals and in recent years removal of the pituitary has been found to accomplish the same effect The mechanism by which the beneficial responses occur appears to be withdrawal of certain hormones upon which the growth of the tumors is partially dependent The rationale for employing hypophysectomy is that the gonads and the adrenals rely for their functions upon the pituitary and that

the operation accomplishes in effect at once what can be accomplished by ablation of the other glands alone or in combination

The problem of management of malignancy in the breast and prostate is especially pertinent in older persons In a series of nearly 300 women with metastatic breast cancer subjected to hypophysectomy by the author 20 per cent were over the age of 60 and a few of these were over 70 In a smaller series of men with metastatic prostatic cancer the majority were over 60

The technique of hypophysectomy has been improved to a degree that complications are reduced to a minimum The mortality is about 6 per cent in the first 30 days following the operation but is due for the most part to the advanced stage of the cancerous disease in those who fail to respond to pituitary ablation

Following hypophysectomy patients are required to take 2 grains of thyroid and 35 mg of cortisone daily by mouth as substitution for the loss of thyrotropic and adrenotropic hormones On this regimen patients usually feel well and do not have any of the appearance of endocrine dysfunction Some also require pitressin to counteract diabetes insipidus Pitressin is usually taken in the form of snuff and but few continue to require it since the condition tends to subside after a while

No preliminary tests have been found helpful in predicting the effect of hypophysectomy on the disease with one possible exception In premenopausal women or possibly some in their fifties if ablation of the ovaries produces a temporary remission of the disease an additional remission is found to occur after hypophysectomy in 80 per cent but this is of no use in older women Any patient with evidence of advancing disease is regarded as a candidate for the operation unless metastases are too far advanced in the brain lungs or liver While some of the most dramatic results of hypophysectomy have been relief of pain and remobilization in patients with skeletal metastases cancerous dissemination to other parts of the body responds in nearly equal degree

In the evaluation of the effects of hypophysectomy for advanced breast cancer in women of all ages 42 per cent obtained objective remissions which lasted 6 months or longer and which averaged 16 5 months The remission rate is notably better in women over 60 (12 of 16 cases) and may prove, with more experience, to be in the neighborhood of 70 per cent as contrasted to 42 per cent for all ages Statistical evaluation of the results of hypophysectomy in men with advanced prostatic cancer is not possible because of limited numbers but experience thus far suggests that the results may be as effective as those in women with breast cancer

Hypophysectomy must be regarded as a palliative measure in the treatment of metastatic cancer of the breast and prostate but as such it appears not only to be the equal of any other method of endocrine treatment or ablative procedure but also to possess certain advantages over the others It is suggested therefore that primary hypophysectomy be considered in the early treatment of these two metastatic diseases The operation does not preclude the additional or later use of roentgentherapy or chemotherapy if they are found desirable

MISCELLANEOUS CONDITIONS

Ten cases are designated as miscellaneous in the list of a year s neurosurgical operations on persons over the age of 60 These include peripheral nerve repair (2), repair of depressed skull fracture (2) drainage of brain abscess (1) division of the acoustic nerve for Meniere s disease (1) repair of intracranial aneurysm (3) and evacuation of intracerebral clot of spontaneous origin (1) This list in large part merely emphasizes that older persons are subject to many of the illnesses or injuries that afflict younger persons and that the need for surgical treatment is the same

Perhaps special comment is called for in regard to the intracranial hemorrhagic lesions in the aged While thrombosis and cerebral softening are more often the cause of cerebral vascular accidents in those over 60 years of

age hemorrhage may spring from one of two common sources rupture of an aneurysm or rupture of a sclerotic artery in a hypertensive patient

Intracranial aneurysms are of two types saccular and arteriovenous anomalies With few exceptions they are of congenital origin and come to recognition mostly in early and middle life but about 10 per cent predominantly the saccular type rupture for the first time after the age of 60 When spontaneous subarachnoid hemorrhage occurs a ruptured saccular aneurysm is the lesion to suspect first Since saccular aneurysms occur principally on the major vessels at the base of the brain in the circle of Willis or its immediate branches the bleeding from a rupture is primarily into the subarachnoid space However ruptured aneurysms of the anterior cerebral arteries may form a hematoma in the frontal lobe or may even burst into the ventricle and aneurysms of the middle cerebral artery may form a hematoma in the temporal lobe or extravasate into the sylvian fissure

Hemorrhage into the subarachnoid space produces immediate pain in the head commonly over one eye or at the occiput and of such suddenness at times that the patient feels that he may have been struck on the head Whether or not there is loss of consciousness depends on the degree of the hemorrhage In the more serious cases immediate coma is followed in some hours by death while in the less serious ones headache may remain the only symptom with stiff neck and low grade fever added within one to several days Ruptured aneurysms near the oculomotor nerve often produce a degree of palsy evidenced by dilated pupil drooping of the upper eyelid and loss of extraocular movements supplied by the nerve A hematoma in the temporal lobe or in the sylvian fissure may produce a hemiparesis on the opposite side and an aphasia if the lesion is in the dominant hemisphere

The diagnosis of subarachnoid hemorrhage is made by lumbar puncture When the test is performed in the first few days after the hemorrhage the fluid may be grossly bloody but it can be distinguished from a traumatic tap by identifying xanthochromia in the serum of a centrifuged specimen The yellow pigment appears in the serum within a few hours after the hemorrhage and may not disappear for 2 to 3 weeks thereafter Usually the spinal fluid pressure becomes elevated soon after the hemorrhage and the polymorphonuclear cells in the fluid increase leading at times to a mistaken diagnosis of bacterial meningitis

The diagnosis of an intracranial aneurysm can be verified only by angiography a test which has come to be a fairly routine procedure in neurosurgery attended by minimal risk It can be and should be performed reasonably soon after the rupture has occurred if the patient s general condition permits

Criteria for determining which aneurysms are suitable for surgical treatment as well as appropriate methods of dealing with the various types of aneurysm are still in the formative period of development but many successful operations are performed thereby reducing the serious risk of subsequent fatal hemorrhage which characterizes the untreated aneurysm

The hemorrhages that accompany hypertensive vascular disease unlike those from aneurysms occur primarily from thin sclerotic vessels in the substance of the brain and tend to dissect in the white matter of the hemisphere The symptoms at the onset are often indistinguishable from those of hemorrhage from an aneurysm since there is usually some blood or xanthochromia in the spinal fluid and the existence of hypertensive disease is not reliable as a means of differentiating the two conditions Cerebral hemorrhage more consistently produces hemiparesis hemianopsia or aphasia and roentgenograms of the skull may show a lateral shift of a calcified pineal gland away from the hemorrhagic and edematous brain Cerebral angiography will usually show a distortion of the normal vascular pattern indicating the presence and location of a hematoma

Present day interest in cerebral hemorrhage has been influenced by two factors

(1) the need for differentiating hemorrhage from thrombosis in determining the indication or danger of anticoagulant therapy and (2) the possible usefulness of surgical evacuation of the hematoma The purpose of the operation is to interrupt the increasing intracranial pressure that may be fatal and to minimize damage to the brain thereby reducing the sequelae It may be difficult to recognize when the hemorrhage is small enough to be tolerated without risk to life or when it is so massive that surgery would be of no avail Good judgment is required in selecting the patients that may be most helped Mistakes in decision are sometimes unavoidable, and at best the results are not brilliant but the effort will often enough be repaid by the salvage of a patient otherwise destined to lose his life or to be left in useless invalidism

BIBLIOGRAPHY

Alexander E Jr Davis C and Field C H Metastatic Lesions of the Vertebral Column Causing Cord Compression Neurology 6 103 1956

Bailey A A Changes with Age in the Spinal Cord A M A Arch Neurol & Psychiat 70 299 1953

Davidoff L M Intracerebral Hemorrhage Associated with Hypertension and Arteriosclerosis J Neurosurg 15 322 1958

Moersch F P Craig W McK and Kernohan J W Tumors of the Brain in Aged Persons Arch Neurol & Psychiat 45 235 1941

Mullan J and Evans J P Neoplastic Disease of the Spinal Extradural Space A M A Arch Surg 74 900 1957

Pearson O H and Ray B S Results of Hypophysectomy in the Treatment of Metastatic Mammary Carcinoma Cancer 12 85 1959

Ray B S and Pearson O H Hypophysectomy in the Treatment of Advanced Cancer of Breast Ann Surg 144 394 1956

Rupp C Riggs H E Hogan H W and Moulton A L Primary Brain Tumors in Patients over Age 60 Neurology 3 586 1953

Stuteville P and Welch K Subdural Hematoma in the Elderly Person J A M A 168 1445 1958

Wright I S Adams R D Covalt D A Fazekas J F and Merritt H H Cerebrovascular Disease with Aging Bull New York Acad Med 32 657 1956

27

Ophthalmic Surgery

John M McLean

Ophthalmic surgery in the aged may be divided into three main types according to objective Most of the surgical procedures are directed towards restoration or preservation of vision Those designed for preservation of life primarily by eradication of malignancies are much fewer in number While less pressing than the other two a third group aimed at improvement of appearance or comfort should not be discounted too much for morale building results of such procedures can be very important to persons in the steadily increasing old age segment of our population

ANESTHESIA, RISK AND GENERAL CONSIDERATIONS

Many of the factors which are of major importance in general surgery of elderly persons are of lesser significance in surgery of and about the eye While it may sometimes be desirable general anesthesia is hardly ever necessary Most ocular surgery in adults is done under local anesthesia by choice and much of the rest of it can be whenever a general anesthetic would appear to present any significant hazard Superficial operations on the eyeball can be done under instillation anesthesia or subconjunctival infiltration or both Operations in which the globe is opened are usually done under retrobulbar nerve block which provides not only sensory block but akinesia of the extraocular muscles and lowering of intraocular pressure These latter two are very important safety factors in intraocular manipulations Combined with motor block of the facial nerve they allow most intraocular procedures to be performed with deliberation and thoroughness without undue risk of expulsion of intraocular contents This same type of local anesthesia is adequate for removal of an eye Most of the plastic operations on the ocular adnexa can be performed well under local infiltration or regional block

Surgical shock a very real problem in general surgery of the aged is almost nonexistent in eye operations Blood loss too is a factor which rarely presents a problem This fortunate combination of circumstances makes it very rare indeed that a patient will not be able to withstand eye surgery

Postoperative management of the eye patient has been changed so much in recent years that binocular bandaging and prolonged bed rest are virtually eliminated These changes which have been brought about mainly by more efficient and secure wound closure have very substantially reduced postoperative complications The senile patient who used to be prone to mental confusion and even to more serious mental disturbance when suddenly cut off from visual contact with his surroundings by binocular bandages rarely gets into difficulty when his unoperated eye is left uncovered Cardiovascular and pulmonary complications as well as urinary retention are approaching the vanishing point since firmer wound closure has allowed early or even immediate postoperative ambulation

OPERATIONS FOR VISION

Cataract

Extraction of cataract is the most frequent operation undertaken for restoration of vision. Comparison of the surgical statistics of The New York Hospital–Cornell Medical Center over the past 20 years shows that this operation has increased from the sixteenth most common to the fourth most frequent one. Throughout this period it has always been the most common eye operation.

Performed by choice under local anesthesia with monocular bandaging and immediate ambulation, it presents no real primary risk to life. In skilled hands the local complications are few. When ocular structures other than the lens are of adequate function, excellent visual results are to be expected. Where coexisting lesions of other ocular structures preclude normal acuity, the eye usually regains about the vision it had before the onset of the cataract. It is true that optical correction of the aphakic state is required to achieve the full visual potential and that the ordinary spectacle cataract glass leaves something to be desired with its narrowed visual field, object magnifications and peripheral distortion. However, most elderly patients adjust well to these circumstances and are well and happily visually rehabilitated. The attendant lack of accommodation in this group is no problem, for they are already used to this loss. It is also true that a spectacle lens cannot usually correct monocular aphakia to achieve fusion with a fellow phakic eye. Increasing numbers of aphakes are taking well to contact lenses, which restore much more nearly the normal optical situation. If the plastic intraocular lenses which are now on trial stand the test of time, an even closer approach to restoration of normal vision as well as normal activity may be possible.

Glaucoma

The leading cause of irremediable and unnecessary blindness in the old age group is unrecognized or untreated glaucoma of one or another type. Heading the list as the most common is open angle glaucoma with its well known lack of warning symptoms until considerable irreversible visual loss has been suffered. Routine ophthalmoscopy in the course of every physical examination has helped to uncover many of these cases, and routine tonometry would help still more. Angle closure glaucoma occurs only in anatomically predisposed eyes, but the structural changes of later life with continued growth of the lens and narrowing of the anterior chamber augment this predilection. The acute phase of this disease is generally reversible by intensive treatment with miotics and carbonic anhydrase inhibitors supplemented, if need be, by osmotic therapy. Once the acute episode is controlled, surgery must always be considered. Peripheral iridectomy is so safe, so simple and so effective in eliminating the mechanism of the disease that recourse to continued palliative treatment is rarely justified. Since the fellow eye is almost invariably in a similar anatomic state, prophylactic surgery on it is usually also essential. In only two instances can one reasonably justify nonsurgical management of this disease beyond control of the acute attack. One is the extremely aged patient with very short life expectancy who may be adequately managed for his remaining days by a miotic regime. The other is the patient on whom lens extraction for coexisting cataracts is planned in the very near future, for this operation includes an anatomic cure of the angle closure disease. General surgery itself may be the precipitating factor in acute angle closure glaucoma. Mydriasis induced by apprehension and augmented by systemic use of drugs of the atropine type often sets off an acute attack. When the predisposing narrow blockable filtration angle is recognized or suspected, adequate preoperative administration of miotics can avert this complication. The general surgeon should be alerted to the possible risk by history of the premonitory signs of iridescent vision and transient episodes of ocular pain and redness.

Recognition by the general surgeon of

severe acute glaucoma with its generalized headache prostration and vomiting is of major importance Surgical interns in various hospital emergency rooms have been known to diagnose such patients as having brain tumor acute appendicitis peritonitis and ruptured gastric ulcer[1]

The secondary glaucomas are more complicated in their recognition and management and are too varied for detailed discussion here One very important type deserves special mention The lens induced glaucoma which may complicate a neglected hypermature cataract must be guarded against No form of ordinary antiglaucoma operation is really effective in these cases Tension should be temporarily lowered by medical means and the lens removed in its capsule even in the face of inflammatory signs Prophylaxis of course consists in removing such lenses before this complication can arise even though the cataract be monocular

Detached Retina

Detachment of the retina is also increasing in frequency as the number of elderly and aphakic patients rises The various types of scleral resection with and without implantation of plastic material have increased the percentage of good results and at the same time decreased the period of postoperative immobilization and binocular occlusion Neglect or pessimistic refusal to advise surgery in cases of detachment on the grounds that the other eye will provide adequate vision are to be decried Detachment in one eye is so frequently followed by detachment in the other that no reasonable effort should be spared to repair either one Age in itself is not a contraindication Recent work with vitreous implantation from eye bank eyes and also with photocoagulation add to our armamentarium of potential approaches to this condition

Corneal Transplantation

Grafting or transplantation of cornea is becoming increasingly useful and successful in all age groups including the elderly Donor material is occasionally available from a freshly enucleated eye which has a normal cornea but it usually is obtained from an eye bank Most bank eyes are those which are obtained immediately post mortem under aseptic conditions Obviously the cause of death is a factor in determining the suitability of these eyes for grafting purposes At the time of this writing demand for corneas far exceeds the supply and the need for more donor material cannot be overemphasized It would be of enormous help to ophthalmic surgeons and mankind in general if more physicians would keep this in mind and request eyes post mortem when seeking autopsy permission Many university hospital centers maintain their own banks and adequate arrangements for free and sterile transportation of donor eyes to and from other institutions are available [1]

Corneal grafts may be either full or split thickness as the occasion demands and are firmly anchored by direct sutures of either No 000000 size or finer In the older age group of patients the majority of transplants are used to replace corneal scars with clear tissue for restoration of vision Other indications also exist including the various corneal dystrophies which may induce serious visual impairments in advancing years other trophic changes and various types of indolent corneal ulcers Some of these ulcers respond extremely well to excision and replacement by split thickness grafts but do very poorly under all other forms of therapy At times it may be necessary to perform a split thickness transplantation to accomplish healing of an ulcer and then a later full thickness graft for optical purposes Corneal grafts practically always take and unlike skin grafts virtually never slough The problem is not one of healing but one of healing with maintenance of adequate transparency Fortunately when a graft fails to stay clear

[1] Detailed information on technique materials legal permission and arrangements for transportation by American Red Cross and various airlines are available through the Eye Bank for Sight Restoration Inc New York N Y Full cooperation is assured by this nonprofit charitable institution

the procedure can usually be repeated with a fair prospect of transparency on regrafting

Since bank eyes' have a limited time period in which they are suitable as donor material even though stored under conditions similar to those used for blood preservation other methods of storage for longer periods are important subjects of investigation At the present time only human corneas appear suitable but race, age and blood type of donor have not proved important Methods of storage by freeze drying now appear to offer promise, and there is a hint that such techniques may make it possible in the future to use nonhuman corneas

OPERATIONS FOR MALIGNANCIES

Intraocular Tumors

Primary intraocular malignancies are not common in the age group being considered Malignant melanoma is sometimes found but usually this ocular tumor has its onset earlier in life When it does develop enucleation is the only course to pursue since the tumor is not sensitive to radiation or other forms of nonsurgical therapy Radioactive phosphorus uptake may be useful in making a differential diagnosis if there should be difficulty by ordinary clinical means If the growth has extended through the walls of the globe exenteration of the entire orbit must of course be resorted to unless distant spread of this rather widely metastasizing lesion has already made the situation hopeless

Metastatic tumors to the eye especially to the choroid are more common late in life Occasionally enucleation is justified to control the pain of secondary glaucoma in a hopelessly blind eye and at times irradiation gives satisfactory palliative results When the latter step is taken the risk of radiation damage particularly cataract must be considered In most cases of intraocular metastasis generalized spread makes the outlook for life so short that no form of therapy is in order Palliative sensory nerve block by intraorbital alcohol injection may be considered for pain control

Orbital Tumors

Tumors of the orbital structures present definite problems in diagnosis and management Determination of the location of the mass is important in deciding on the approach When it can be palpated from the front the surgical route is not difficult to plan Deeper tumors require further steps Direction of displacement of the eye and evaluation of the involvement of extraocular muscles, visual field defects and sensory nerve palsies together with radiographic evidence of bone involvement help in locating the tumor Pneumotomography in which the soft tissues of the orbit are insufflated with oxygen and tomograms taken in frontal and lateral planes has proved invaluable in marking out the location and extent of deep orbital tumors In a properly executed pneumotomogram the eye itself the optic nerve and the extraocular muscles as well as the tumor are well outlined and visualized When size and location of the mass are known surgical approach can be planned Exploration and biopsy can usually be performed through either the anterior or the temporal approach When radiographic or other evidence shows that the bony wall of the orbit has been invaded or that tumor has extended posteriorly through the optic foramen, it may be better to use the intracranial approach On the basis of the exploration and biopsy, definite therapy is planned Simple excision of benign masses may be done through the lids but more often approach through the lateral orbit wall is advisable This approach gives better exposure and is simple to effect Inflammatory pseudotumors require only diagnostic confirmation followed by nonsurgical treatment Primary malignancies usually require exenteration of the entire orbit This radical removal is completed by skin grafting and may also be improved cosmetically if some of the large cavity is filled by temporal muscle

transplant One must consider, however that simple split thickness skin grafting in bare bone gives a good surgical closure with a satisfactory dry orbit in which subsequent tumor recurrence is easier to recognize and manage

Superficial Tumors

The greatest number of tumors around the eye in later life are superficial involving the structures of the lids and conjunctiva The commonest of all is basal cell carcinoma of the senile lid With such lesions either radiation therapy or surgical excision may be used Frequently the latter yields a more satisfactory end result When irradiation results in cure of the tumor with a tissue defect which both constitutes a cosmetic blemish and causes a deficit in function its subsequent repair often requires a procedure similar to the operation which would have been used for simple surgical cure in the first place

Small lesions of or near the lid margin must be resected with adequate margins and care taken to close with satisfactory restoration of lid structures In the nasal area particular care must be paid to the lacrimal excretory mechanism Often sliding flaps of whole lid from the temporal side will suffice If more lid must be resected there are many techniques for its replacement Some of the best utilize partial replacement by normal structures from the opposing lid When the margin and the deeper lid structures can be spared simple full thickness skin grafting may be all that is required Temporary closure of the lids by marginal tarsorrhaphy helps to stabilize the bed of the graft and avoid excessive contracture The best skin to replace lid skin is lid skin This may usually be obtained from the opposite upper lid where surprisingly large areas can be borrowed with impunity Lacking this post auricular skin is a second choice and supra clavicular a third When eyebrow area is to be sacrificed hair bearing grafts should be planned

Tumors of the conjunctiva must be replaced by mucous membrane If skin is allowed to come in contact with the cornea an intractable keratitis ensues Sliding or free grafts of conjunctiva of the same eye are preferred free conjunctival grafts from the other eye are a second choice and free grafts of distant mucous membrane (buccal preputial labial) are held in reserve

COSMETIC SURGERY

Repair of senile cosmetic defects about the eye requires good clinical judgment Ambitions of the elderly to appear young again through various types of face lifting must be given careful consideration Not every request is to be rejected for some of them may be justified from a psychological view point On the other hand many suggestions must be recognized as mere caprice and evaluated in the light of the patient s real need and the amount that can actually be accomplished Those who will never really be happy with what surgery can offer ought to be identified and urged to live with their normally aging physiognomies The eager inexperienced young plastic surgeon can do himself and these patients real harm if he is too anxious to operate When these cosmetic defects include deficiencies in function indication for operation is more definite but surgery must be aimed primarily at restoration of function and only secondarily at appearance

Entropion and Ectropion

Senile malpositions of the lids are common Most of these are accompanied by alterations in function and require repair Senile ectropion is caused by excessive tissue relaxation and may result in exposure conjunctivitis or keratitis The latter if untreated may progress to ulceration secondary infection and even loss of the eye Tightening of such a loose lid is easily accomplished with very satisfactory and lasting result by wedge resection of skin and tarsus in

offset layers The minor variations in details of technique are almost endless and generally unimportant if proper basic principles are understood In general, senile ectropion may be divided into two main groups The larger group comprises massive relaxations of the lid and requires large skin triangle resection The smaller group includes those lids in which relaxation is mostly marginal and the lid border tends to be rolled out When this is recognized as differing from the condition in which the lid falls away from the eye in bulk a better result is obtained by removing a tarsal wedge and advancing a narrow strap of skin close to the lid margin

Cicatricial ectropion may follow burns or other scars as well as ill advised face lifting Such scars must of course, be resected and the contracture relaxed Sometimes V-Y or other geometric relaxing patterns can be used but usually full thickness grafting is required

Senile entropion is usually spastic in nature and results from relative overactivity of the marginal portion of the orbicularis Correction of this condition by Y-V counteraction in the skin or by scar producing cautery punctures is temporary at best Subcutaneous tightening, by resecting or tucking of the basal layers of the orbicularis gives a more physiologic and lasting restoration of normal balance

Cicatricial entropion may result from conjunctival or tarsal contracture In the former case scar resection and replacement is in order in the latter, wedge resection to straighten the bowed tarsal plate

Miscellaneous

Bagginess of the lids is a common complaint in older persons If this cosmetic defect deserves correction at all it is important to recognize its mechanism and operate accordingly Simple senile relaxation and redundancy of skin may be treated by simple rhytidoplasty Large redundant skin folds of the upper lid which may even hang down beyond the margin to obstruct vision are usually the result of chronic blepharochalasis Unless the tissue resection in these cases is combined with anchoring to the upper tarsal margin, recurrence will be prompt Senile pouches under the lower lids are often not simple skin relaxation but actual hernias of orbital fat through the tarsoorbital fascia to subcutaneous space The not uncommon error of attempting to correct this condition by skin excision may result in cicatricial ectropion as well as failure to correct the original defect Skin resection plus simple excision of the herniated fat is little better The principles of true hernia repair should be applied to the basic fascial defect

Senile warts, keratoses, and cutaneous horns of the lids merit excision both as cosmetic defects and as potential premalignancies So too does intraepithelial epithelioma of conjunctiva and cornea

Pterygium is not particularly a lesion of advanced years but age does not confer immunity to it Excision or transplantation of this lesion is required when its extent and rate of growth threaten visual impairment

BIBLIOGRAPHY

Atkinson W S *Anesthesia in Ophthalmology* Charles C Thomas Publisher Springfield Ill 1955

Bettman J W and Fellows V Radioactive Phosphorus as a Diagnostic Aid in Ophthalmology A M A Arch Ophth 51 171 1954

Callahan A *Surgery of the Eye Diseases* Charles C Thomas Publisher Springfield Ill 1956

Constantine E F and McLean J M Contact Lenses in Aphakia A M A Arch Ophth 51 212 1954

Dubilier W von Gel H Freemond A and Evans J A Orbital Pneumotomography Radiology 66 387 1956

Galin M A Aizawa F and McLean J M Urea as an Osmotic Ocular Hypotensive Agent in Glaucoma A M A Arch Ophth 62 347 1959

Iliff C Tumors of the Orbit Tr Am Ophth Soc 55 505 1957

King J H The Use of Preserved Ocular Tissues for Transplantation Tr Am Ophth Soc 56 203 1958

Kirby D B *Surgery of Cataract* J B Lippincott Company Philadelphia 1953
McLean J M Management of the Primary Glaucomas Am J Ophth 44 323 1957
McLean J M Some Problems in Relation to Retinal Detachment Eye Digest 3 18 1957
Packer H Deutsch A R Lewis P M
Oglesby C D and Chey A C Study of the Frequency and Distribution of Glaucoma J A M A 171 1090 1959
Paton R T *Keratoplasty* McGraw Hill Book Company Inc New York 1955
Reese A B *Tumors of the Eye* Paul B Hoeber Inc Medical Department of Harper & Brothers New York 1953

offset layers The minor variations in details of technique are almost endless and generally unimportant if proper basic principles are understood In general senile ectropion may be divided into two main groups The larger group comprises massive relaxations of the lid and requires large skin triangle resection The smaller group includes those lids in which relaxation is mostly marginal and the lid border tends to be rolled out When this is recognized as differing from the condition in which the lid falls away from the eye in bulk a better result is obtained by removing a tarsal wedge and advancing a narrow strap of skin close to the lid margin

Cicatricial ectropion may follow burns or other scars as well as ill advised face lifting Such scars must of course, be resected and the contracture relaxed Sometimes V-Y or other geometric relaxing patterns can be used but usually full thickness grafting is required

Senile entropion is usually spastic in nature and results from relative overactivity of the marginal portion of the orbicularis Correction of this condition by Y V counter action in the skin or by scar producing cautery punctures is temporary at best Subcutaneous tightening by resecting or tucking of the basal layers of the orbicularis gives a more physiologic and lasting restoration of normal balance

Cicatricial entropion may result from conjunctival or tarsal contracture In the former case scar resection and replacement is in order in the latter wedge resection to straighten the bowed tarsal plate

Miscellaneous

Bagginess of the lids is a common complaint in older persons If this cosmetic defect deserves correction at all it is important to recognize its mechanism and operate accordingly Simple senile relaxation and redundancy of skin may be treated by simple rhytidoplasty Large, redundant skin folds of the upper lid which may even hang down beyond the margin to obstruct vision are usually the result of chronic blepharochalasis Unless the tissue resection in these cases is combined with anchoring to the upper tarsal margin, recurrence will be prompt Senile pouches under the lower lids are often not simple skin relaxation but actual hernias of orbital fat through the tarsoorbital fascia to subcutaneous space The not uncommon error of attempting to correct this condition by skin excision may result in cicatricial ectropion as well as failure to correct the original defect Skin resection plus simple excision of the herniated fat is little better The principles of true hernia repair should be applied to the basic fascial defect

Senile warts keratoses and cutaneous horns of the lids merit excision both as cosmetic defects and as potential premalignancies So too does intraepithelial epithelioma of conjunctiva and cornea

Pterygium is not particularly a lesion of advanced years but age does not confer immunity to it Excision or transplantation of this lesion is required when its extent and rate of growth threaten visual impairment

BIBLIOGRAPHY

Atkinson W S *Anesthesia in Ophthalmology* Charles C Thomas Publisher Springfield Ill 1955

Bettman J W and Fellows V Radioactive Phosphorus as a Diagnostic Aid in Ophthalmology A M A Arch Ophth 51 171 1954

Callahan A *Surgery of the Eye Diseases* Charles C Thomas Publisher Springfield Ill 1956

Constantine E F and McLean J M Contact Lenses in Aphakia A M.A Arch Ophth 51 212 1954

Dubilier W von Gel H Freemond A and Evans J A Orbital Pneumotomography Radiology 66 387 1956

Galin M A Aizawa F and McLean J M Urea as an Osmotic Ocular Hypotensive Agent in Glaucoma A M A Arch Ophth 62 347 1959

Iliff C Tumors of the Orbit Tr Am Ophth Soc 55 505 1957

King J H The Use of Preserved Ocular Tissues for Transplantation Tr Am Ophth Soc 56 203 1958

Kirby D B *Surgery of Cataract* J B Lippincott Company Philadelphia 1953
McLean J M Management of the Primary Glaucomas Am J Ophth 44 323 1957
McLean J M Some Problems in Relation to Retinal Detachment Eye Digest 3 18 1957
Packer H Deutsch A R Lewis P M Oglesby C D and Cheij A C Study of the Frequency and Distribution of Glaucoma J A M A 171 1090 1959
Paton R T *Keratoplasty* McGraw Hill Book Company Inc New York 1955
Reese A B *Tumors of the Eye* Paul B Hoeber Inc Medical Department of Harper & Brothers New York 1953

offset layers The minor variations in details of technique are almost endless and generally unimportant if proper basic principles are understood In general senile ectropion may be divided into two main groups The larger group comprises massive relaxations of the lid and requires large skin triangle resection The smaller group includes those lids in which relaxation is mostly marginal and the lid border tends to be rolled out When this is recognized as differing from the condition in which the lid falls away from the eye in bulk a better result is obtained by removing a tarsal wedge and advancing a narrow strap of skin close to the lid margin

Cicatricial ectropion may follow burns or other scars as well as ill advised face lift ing Such scars must of course be resected and the contracture relaxed Sometimes V-Y or other geometric relaxing patterns can be used but usually full thickness grafting is required

Senile entropion is usually spastic in nature and results from relative overactivity of the marginal portion of the orbicularis Correction of this condition by Y V counter action in the skin or by scar producing cautery punctures is temporary at best Sub cutaneous tightening by resecting or tuck ing of the basal layers of the orbicularis gives a more physiologic and lasting restora tion of normal balance

Cicatricial entropion may result from con junctival or tarsal contracture In the former case scar resection and replacement is in order in the latter wedge resection to straighten the bowed tarsal plate

Miscellaneous

Bagginess of the lids is a common com plaint in older persons If this cosmetic defect deserves correction at all it is important *to recognize its mechanism and operate ac*cordingly Simple senile relaxation and re dundancy of skin may be treated by simple rhytidoplasty Large redundant skin folds of the upper lid which may even *hang down* beyond the margin to obstruct vision are usually the result of chronic blepharochalasis *Unless* the tissue resection in these cases is combined with anchoring to the upper tarsal margin recurrence will be prompt Senile pouches under the lower lids are often not simple skin relaxation but actual hernias of orbital fat through the tarsoorbital fascia to subcutaneous space The not uncommon error of attempting to correct this condition by skin excision may result in cicatricial ec tropion as well as failure to correct the orig inal defect Skin resection plus simple ex cision of the herniated fat is little better The principles of true hernia repair should be applied to the basic fascial defect

Senile warts keratoses and cutaneous *horns of the lids merit excision both as cos*metic defects and as potential premalignan cies So too does intraepithelial epithelioma of conjunctiva and cornea

Pterygium is not particularly a lesion of advanced years but age does not confer immunity to it Excision or transplantation of this lesion is required when its extent and rate of growth threaten visual impairment

BIBLIOGRAPHY

Atkinson W S *Anesthesia in Ophthalmology* Charles C Thomas Publisher Springfield Ill 1955

Bettman J W and Fellows V Radioactive Phosphorus as a Diagnostic Aid in Ophthal mology A M A Arch Ophth 51 171 1954

Callahan A *Surgery of the Eye Diseases* Charles C Thomas Publisher Springfield *Ill 1956*

Constantine E F and McLean J M Con tact Lenses in Aphakia A M A Arch Ophth 51 212 1954

Dubilier W von Gal H Freemond A and Evans J A Orbital Pneumotomography Radiology 66 387 1956

Galin M A Aizawa F and McLean J M Urea as an Osmotic Ocular Hypotensive Agent in Glaucoma A M A Arch *Ophth* 62 347 1959

Iliff C Tumors of the Orbit Tr Am Ophth Soc 55 505 1957

King J H The Use of *Preserved* Ocular Tis sues for Transplantation Tr Am Ophth Soc 56 203 1958

In the treatment of acute suppurative middle ear infections in the aging patient a thorough clinical evaluation is essential along with identification of the organism involved and sensitivity studies Early myringotomy should be carried out where indicated Careful and repeated x ray films of the mastoids are frequently helpful and where indicated or in the presence of threatened intracranial complications mastoid surgery is essential All too frequently the patient is treated for the complications such as meningitis or a brain abscess and the middle ear infection which has caused the complication is overlooked at least in the early stages of the treatment of the complication In the presence of such complications the possibility that they are secondary to an ear infection should be considered and a competent otologist should be called in

Chronic Purulent Otitis Media

In adults and particularly in the older age group an acute suppurative otitis media frequently is found associated with and secondary to an acute and chronic suppurative maxillary sinusitis or pansinusitis on the same side This is so common that approximately fifty per cent of all cases of acute suppurative otitis media in adults are associated with an acute suppurative maxillary sinusitis on the same side It is important to be cognizant of this fact and always to look for and treat the suppurative maxillary sinusitis usually with irrigation through the natural ostium and with antibiotics along with the treatment of the acute suppurative otitis media

Many patients in the older age group are afflicted with an intermittent or chronically discharging ear of some years duration The patient s doctor whether he be a physician or a surgeon should be alert to the seriousness of this condition and to the possibility of serious complications which accompany a chronically discharging ear In a patient with even slight hearing impairment and intermittent or chronic drainage the sudden appearance of headache cessation of discharge vertigo chills and fever or a slight stiff neck should suggest the possibility of a complication and prompt otologic consultation

In evaluating a chronic ear the location and character of the perforation of the tympanic membrane are of the utmost importance Also the character and odor of the discharge are important In a chronic draining ear a large central perforation of the tympanic membrane involving the pars tensa usually indicates a benign type of ear infection An anterior inferior quadrant perforation with mucoid discharge suggests chronic tubal infection and also a benign ear A large central kidney shaped perforation of the pars tensa particularly with a dry middle ear suggests a quiescent condition which probably arose as a result of an acute infection or was related to scarlet fever or measles probably in childhood In contrast a marginal perforation involving any segment of Shrapnell s membrane or the lateral wall of the attic is to be regarded with suspicion usually in this type of perforation squamous epithelium has grown into the attic and mastoid antrum from the external auditory canal with resulting cholesteatomatous formation Such an ear particularly when the perforation is small is a constant threat to the patient s well being or even his life In a chronic ear it takes an average of from 12 to 15 years for the formation of a cholesteatoma of sufficient extent to cause destruction in the mastoid antrum area or attic area and to be suggested by x ray examination In addition in a chronic mastoid where there is marked sclerosis of the mastoid portion of the temporal bone x ray films though well taken may fail to show the presence of a cholesteatoma conclusively The presence or absence of cholesteatoma can best be determined by demonstrating the presence of cholesteatomatous flakes clinically This can be done in the vast majority of cases by one or more examinations and removal of the flakes from the perforation or attic area Occasionally the cholesteatoma has perforated through the posterior and superior

28

Otolaryngologic Surgery

James A Moore

THE EAR

Otologic surgical problems *in the aging* patient consist primarily of the treatment of acute and chronic infections and of malignant diseases Although inner ear disturbances such as progressive nerve type hearing impairment tinnitus and vertigo are common in the aging patient the treatment of these conditions is primarily medical Ear symptoms in the aging patient warrant careful investigation because they frequently suggest carcinoma of the nasopharynx or pharynx A chronic secretory otitis media in the aging patient may be the first sign of a *malignant neoplasm in the area of the fossa* of Rosenmueller or eustachian tube orifice

Acute Otitis Media

Although acute otitis media is most common in the first and second decades of life *it may occur in the aging patient whose re*sistance to infection is lowered for one of many reasons The increasing use of antimicrobial agents has greatly decreased the incidence and severity of middle ear infections However, the aging patient is still prone to certain types of middle ear infections and the complications resulting from them may be fatal The type III pneumococcus Friedlander s bacillus and *Hemophilus influenzae* infections are prone to occur in older persons particularly those suffering from some systemic disease such as diabetes or a blood dyscrasia

Acute and Chronic Secretory Otitis Media

When this condition occurs in the aging patient it is less likely to be related to nasal allergy and recurring infection in the nasopharynx associated with lymphoid hyperplasia and is more likely to suggest eustachian tube obstruction secondary to malignancy Therefore, in the aging patient not only should the usual treatment be carried out consisting of multiple myringotomies or middle ear aspirations, but the condition *should dictate a thorough examination* of the nasopharynx and hypopharynx

Acute Purulent Otitis Media

In the aging patient acute purulent otitis media is more likely to be of the fulminating variety and should be regarded as a serious condition which could easily lead to meningitis lateral sinus thrombosis or other complications When the causative agent is the *type III pneumococcus* the patient may complain only of a dull ache in the ear and some impairment of hearing Physical examination may show only a thickened drum Then even without a rupture of the tympanic membrane or a draining ear, the patient may go on to a complication such as lateral sinus thrombosis meningitis *or other intracranial* complication The type III pneumococcus notoriously destroys bone and causes com*plications frequently* in almost a silent manner Friedlander s bacillus and *H influenzae* may also be responsible for complications in the aging patient

the mastoid process, destruction of the lateral sinus plate and destruction of the tegmen with exposure of the dura over the temporal lobe and cerebellum, was revealed Gross erosion of the bony labyrinth was noted as well as exposure by disease of the facial nerve Following operation the facial weakness disappeared and the patient made an uneventful recovery to be discharged on the twenty fifth postoperative day

Most elderly patients with attic perforations and cholesteatomas should be treated surgically Most frequently an endaural modified radical mastoidectomy will suffice to eliminate disease and at the same time maintain useful hearing However when the middle ear is involved and where useful hearing has already been destroyed the endaural radical mastoid operation is indicated

In elderly patients with chronically discharging ears or intermittent discharging ears with marginal perforations with or without cholesteatoma the onset of pain in the temporal area localized headache vertigo chills and fever or facial paralysis indicates threatened intracranial complications and therefore prompt surgical intervention

Tinnitus

Tinnitus is a common and particularly annoying symptom in the aging patient Tinnitus aurium should be distinguished from tinnitus cranii In tinnitus aurium the sound is referred to the ear and can usually be masked by an appropriate noise or masking device applied to one or both ears On the other hand tinnitus cranii may be described as a generalized roaring sound in the head which is poorly localized and lacks the more specific character of true tinnitus aurium Tinnitus aurium is usually divided into subjective or nonvibratory tinnitus and objective or vibratory tinnitus (sometimes spoken of as pseudotinnitus) True tinnitus or nonvibratory tinnitus is perceived by the subject himself and cannot be heard by the examiner On the other hand objective tinnitus or vibratory tinnitus is heard by both the patient and the examiner Pseudo- or objective tinnitus is not common and is caused by various diseases of the vascular system particularly intracranial arteriovenous aneurysms, or by muscular contractions arising in the muscles related to the eustachian tube namely the tensor veli palatini and levator veli palatini which cause faint crackling sounds on contraction Objective tinnitus may also be caused by contraction and relaxation of the tympanic muscles the tensor tympani and stapedius True tinnitus or nonvibratory tinnitus is caused by irritative or degenerative changes in the hair cells of the auditory nerve the spiral ganglion or the various pathways of the central nervous system

True tinnitus is the result of biochemical changes occurring in the nerve mechanism of hearing This change is usually irritative or degenerative in type such as the degeneration in the inner ear which gives rise to tinnitus and deafness of the presbycusis type These biochemical changes may also be caused by the absorption of toxins from sources such as acute or chronic infection metabolic disturbances and endocrine disturbances such as hyperthyroidism The prolonged ingestion of drugs and chemicals such as quinine and salicylates or the prolonged use of alcohol and tobacco may also give rise to these biochemical changes causing tinnitus Any substance which is toxic to the nerve tissue of the auditory mechanism may cause nonvibratory tinnitus Such substances as arsenic lead carbon monoxide carbon disulfide phosphorus morphine atropine and the aniline dyes may give rise to true tinnitus through this biochemical change

Tinnitus may also follow degenerative changes in the inner ear as a result of ear or acoustic trauma Tinnitus is commonly seen in patients with occupational deafness secondary to acoustic trauma

Various diseases of the ear may also cause true or nonvibratory tinnitus A small foreign body or a small piece of impacted cerumen which touches the tympanic membrane may give rise to a very annoying tinnitus which ceases immediately after the offending

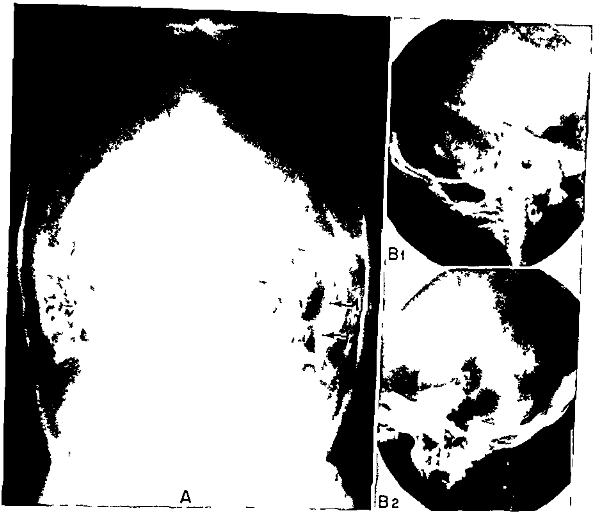


Fig 28 1 Mastoid x ray films (male age 58) showing involvement of the left mastoid process by cholesteatoma *A* Fronto occipital view showing extensive disease with destruction of lateral sinus plate (1) and extensive erosion of the bony labyrinth (2) *B* Law s *views showing widespread destruction in the left mastoid process (2)* as compared with the relatively normal right mastoid process (1)

bony canal wall leaving the attic area and tympanic membrane intact A fetid discharge *always suggests bone involvement and should* be viewed as a potentially serious condition

Elderly patients with small marginal perforations and with acute or potential choles teatomas should never have their ears irrigated and should be warned against the use of ear drops particularly peroxide

The above is illustrated by the following case A 58-year old male was admitted to the medical service because of severe occipital headache left facial nerve paralysis, vertigo nausea and vomiting The history revealed that 4 weeks prior to admission the patient had complained of a clogged feeling in his left ear The patient s physician irrigated the left ear and placed the patient on cortisone ear drops After 1 week of ear *drops again the patient complained of* a clogged feeling in his left ear and developed a blood tinged discharge from it The patient was then placed on Achromycin One week later in spite of the Achromycin, the patient developed an acute episode of nausea vomiting and staggering gait associated with a left facial weakness

On the day of admission to the hospital an otologic consultant made the diagnosis of chronic mastoiditis with cholesteatoma involving the left ear X ray films of the mastoids confirmed the diagnosis (Fig 28 1)

A left endaural radical mastoidectomy was performed and extensive destruction within

congenital types A discussion of lesions of the inner ear would be incomplete without mentioning the various types of labyrinthitis due to infection Labyrinthitis of this type may be serous suppurative or circumscribed The infection may reach the inner ear through the round or oval windows by way of the vascular channels as well as by fistulas in the semicircular canals particularly the horizontal semicircular canal

Vertigo Due to Systemic Disease

The labyrinth may be affected by changes in the blood pressure diseases of the blood and by products of diseases in other organs and tissues carried by the circulation Vertigo may be caused by hypertension associated with arteriosclerosis by hypotension from various causes and by anemia or it may be associated with polycythemia vera The toxemia of any severe acute infection such as scarlet fever measles cerebrospinal meningitis malaria or long-continued absorption from a localized chronic infection may cause labyrinthine symptoms Toxic neuritis due to absorption of drugs and chemicals such as alcohol tobacco quinine and salicylates mercury lead arsenic and even caffeine may cause vertigo Metabolic disturbances associated with systemic diseases such as nephritis diabetes pernicious anemia and other systemic disorders may also give rise to labyrinthine irritation and vertigo Disturbed labyrinthine function is frequently seen in severe blood dyscrasias particularly leukemia with resulting leukemic deposits in the labyrinth and consequent impaired circulation Vasomotor changes incident to emotional or psychotic disturbances may occasionally cause vertigo

Meniere s Disease

For practical purposes approximately 50 per cent of all patients seen by an otolaryngologist for severe vertigo are suffering from Meniere s disease Meniere s disease is common usually beginning in middle life and is somewhat more frequent in men than in women The disease is characterized by sudden irregularly recurring attacks of rotary vertigo usually associated with tinnitus and hearing impairment during the acute phase In severe cases, vasomotor symptoms, such as nausea vomiting and sweating frequently occur The attacks may be transient or may continue intermittently severe for a considerable period Usually the earliest signs of the disease are tinnitus and hearing impairment for the lower frequencies Characteristically the patients are aware of a distortion of sound and examination establishes the presence of diplacusis In approximately 90 per cent of cases only one ear is involved

Diagnosis

In making the diagnosis of Meniere s disease or endolymphatic hydrops the history of sudden irregularly recurring attacks of vertigo is most important The medical and neurologic examinations are usually negative Functional tests characteristically reveal a unilateral hearing impairment which in the milder cases affects the lower frequencies primarily and is perceptive in type Recruitment and in many cases hyperrecruitment are present In the more severe and long standing cases the higher frequencies are severely affected Vestibular tests characteristically show a normal or slightly impaired vestibular function in the involved ear In severe cases the vestibular function may be absent

Treatment

The effectiveness of treatment both medical and surgical is difficult to determine because by the nature of the disease spontaneous remissions are frequent and characteristic of the disease Most patients respond to proper medical treatment which includes (1) a salt free or low salt diet usually substituting potassium chloride for sodium chloride (2) hypoallergic diets (3) vasodilating agents particularly nicotinic acid with or without the use of daily intravenous administration of histamine or procaine (4) antihistaminic drugs The acute attacks

substance is removed Tinnitus is common in otosclerosis where the hearing impairment is bilateral and greater than the 30 db level in the speech frequencies Tinnitus is also one of the three diagnostic symptoms of Meniere s disease Usually in an acute exacerbation of Meniere s disease with the onset of vertigo the tinnitus is characteristically worse and the hearing is temporarily or permanently further depressed Tumors of the acoustic nerve and of the cerebellopontine angle may also give rise to tinnitus Various diseases of the central nervous system, notably disseminated sclerosis and multiple sclerosis, may cause tinnitus

The treatment of tinnitus in general is discouraging however in certain types surgical measures have given good results For example in bilateral otosclerosis with severe hearing impairment the majority of patients cease to have appreciable tinnitus in the operated ear following a restoration of useful hearing with either the fenestration operation or the mobilization operation In certain types of tinnitus associated with chronic adhesive processes of the middle ear, resection of the tympanic plexus in the mucous membrane of the promontory of the mesial wall of the middle ear (tympanosympathectomy) may give relief of tinnitus Also in certain occasional cases section of the chorda tympani nerve or injection into the chorda tympani nerve of procaine will relieve tinnitus In severe Meniere s disease where only one ear is involved and the hearing loss is marked the membranous labyrinth may be destroyed by labyrinthotomy and electrocoagulation or the vestibular and cochlear nerve may be sectioned with relief of vertigo in most selected cases and with relief of tinnitus in approximately 50 per cent of patients As a general rule neither a labyrinthotomy nor a nerve section is recommended as a surgical treatment of tinnitus alone

Vertigo

Vertigo may be defined as a disturbed orientation of the patient to his environment or to his normal position in space This altered orientation may result from disturbances in the ocular, kinesthetic or vestibular mechanisms and their central connections which control normal balance Vertigo is a common complaint in the middle aged group and in the aging

Vertigo is a symptom which may be caused by a great many diseases including diseases of the ear itself of the central nervous system, and of systemic origin

Lesions of the External and Middle Ear

Occasionally vertigo may result from such conditions as impacted cerumen which makes contact with the tympanic membrane Diseases of the middle ear such as acute otitis media, chronic secretory otitis media and chronic adhesive middle ear processes which interfere with the mobility of the ossicular chain, especially the stapes, may give rise to vertigo Occasionally obstruction of the eustachian tube, with resulting absorption of air in the middle ear may also give rise to vertigo In a small percentage of patients with otosclerosis particularly fulminating otosclerosis vertigo may be a presenting symptom In several such patients restoration of hearing by the mobilization or the fenestration operation has resulted in unexplained alleviation of the vertigo

Lesions of the Inner Ear

In the aging patient undoubtedly the most common causes of vertigo are the degenerative vascular changes associated with increasing age resulting in impaired blood supply to the vestibular components of the inner ear This impairment of blood supply may be gradual in nature or sudden and may even make its appearance as recurring attacks of vertigo suggesting repeated mild acoustic accidents as the result of obliteration of small end arteries caused by thrombosis or embolism Other degenerative processes in the labyrinth caused by long-continued absorption of toxins or by pressure on the vestibular nerve may also give rise to vertigo Vertigo is seen in syphilis, both the acquired and

Carcinoma of the Auricle

The squamous cell carcinoma is considerably more common than the basal cell carcinoma when the auricle is considered In men carcinoma of the auricle (Fig 28-3) is found to involve the upper border and posterior surface of the pinna whereas in women the concha and external auditory canal are the most frequent sites of involvement The treatment of choice is complete surgical excision and plastic repair where indicated If total excision of the auricle is necessary then either plastic reconstruction of an ear is indicated or else a prosthesis may be considered

Carcinoma of the Middle Ear

In cancer of the middle ear and mastoid the pain may be referred not only to the ear but also to the mastoid and the temporal occipital or frontal areas Pain usually severe is characteristic of this lesion and is frequently poorly controlled by even the opiates Deafness or hearing impairment may occur in an early lesion and may be the only symptom Cancer of the middle ear is most frequently associated with chronic otorrhea suggesting that chronic irritation and resulting metaplasia of the respiratory type of epithelium to the squamous type may be a factor in etiology Bleeding from the external auditory canal particularly in the presence of chronic otorrhea is suggestive of this lesion Particularly in the older age group bleeding aural polyps should be looked upon with suspicion Facial paralysis usually occurs late in the course of the disease Involvement of the labyrinth may also occur however for the most part the bony labyrinth is resistant to invasion

When cancer involves the middle ear one suspects involvement of the mastoid area Therefore in the surgical treatment of carcinoma of the external auditory canal and middle ear a radical mastoidectomy is indicated with complete removal of the growth where possible This should be followed by fractional radiation

The temporal bone may be the primary site of carcinoma or it may be involved secondarily When it is involved by a primary lesion the site of origin is either the middle ear the petrous pyramid or the mastoid process since these structures are lined by upper respiratory epithelium Occasionally the temporal bone may be involved secondarily by extension of the lesions involving the concha external auditory canal or skin over the mastoid or by direct extension from primary lesions of the nasopharynx To date

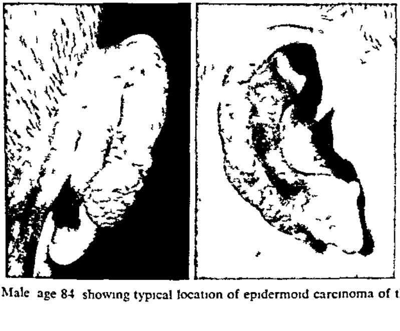


Fig 28 3 Male age 84 showing typical location of epidermoid carcinoma of the auricle



Fig 28 2 Female age 68 showing typical appearance of a small basal cell carcinoma of the auricle The third view (right) shows the result following excision and plastic repair

usually be controlled by heavy sedation with Demerol combined with soluble phenobarbital on the theory that the symptoms are secondary to dysfunction of the autonomic nervous system

Surgical Treatment Where medical treatment has failed after a period of 3 to 6 months and where the vertigo is disabling to the point of making it impossible for a person to carry on his daily duties or activities surgical treatment should be considered Surgery is contraindicated in cases of bilateral involvement and usually even in patients with unilateral involvement when the hearing is at or above the 30 db level for the speech frequencies The effectiveness of surgical treatment depends upon the complete destruction of the involved labyrinth and also the entire membranous cochlea which is usually involved in severe cases

In the surgical treatment of Meniere s disease one has the choice of two different types of procedure The first and older surgical method is intracranial section of the auditory nerve made popular by Dandy The second is labyrinthotomy and total destruction of the membranous labyrinth and cochlea by way of the endaural approach to the mastoid this procedure has been described in detail by Cawthorne and by Day With present day technique the latter appears to be the method of choice Labyrinthotomy and electrocoagulation of the membranous labyrinth and membranous cochlea is a very safe and efficient means of rendering relief from the vertigo The treatment is completely effective in relieving the attacks provided the labyrinthine and cochlear function is entirely destroyed in the affected ear It should also be pointed out that should the patient complain primarily of tinnitus rather than vertigo he should have a very careful psychiatric evaluation in order to determine whether or not he is suitable for surgery

Malignant Tumors of the Ear

Approximately one third of the cases of carcinoma of the auricle arising within 1 cm of the external auditory meatus occur in the sixth decade and approximately another third after age 70 A higher percentage of those arising on the upper free border of the auricle occur after age 60 Approximately 20 per cent of all squamous cell carcinomas of the skin occur on or about the auricle and approximately 3 per cent of all basal cell carcinomas of the skin occur on or about the auricle (Fig 28 2) Carcinoma of the middle ear and temporal bone are distinctly less common than carcinoma of the auricle and for the most part occur usually in the middle age group

labyrinth is the next most frequent sinus cancer and occurs usually in the fourth and fifth decades The frontal sinus may be involved and least frequently the sphenoid sinus

The majority of malignant tumors of the paranasal sinuses are squamous cell carcinomas arising from the mucous membrane lining the cavities Squamous cell carcinomas make up approximately 60 to 65 per cent of malignant tumors arising in this area Various types of sarcomas and some undifferentiated epidermoid carcinomas with cell types not classified and adenocarcinomas make up the remaining 30 to 35 per cent

One of the most common and often early symptoms of cancer of the nose and paranasal sinuses is an *unexplained dull persistent pain* about the face which is usually worse at night or when lying down Bleeding is a frequent but usually late sign Many malignant tumors of the nose and paranasal sinuses become ulcerated and infected Nasal obstruction usually unilateral may be the only symptom In the presence of persistent unilateral nasal discharge or bleeding cancer should be suspected particularly in the older age group In such patients x ray films of the sinuses should always be taken as they may show evidence of destruction at a relatively early stage of disease particularly if the maxillary sinus is involved

Treatment

Considerable progress has been made in the treatment of cancer of the paranasal sinuses since 1935 In general at the present time cancer of the paranasal sinuses particularly of the maxillary sinus is treated either by wide surgical excision or by a combination of surgery and radiation therapy The cardinal principle of treatment is that the affected sinus must either be resected or else opened widely with removal of all of the tumor or as much as possible with or without electrocoagulation Usually at the end of the operation radium or radon seeds are applied locally Routinely this is followed by external irradiation

When the maxillary sinus alone is involved resection of the maxilla consistently gives the best results Even though the disease has involved the posterior wall of the maxillary sinus and has extended into the pterygomaxillary fossa resection of the maxilla may still give satisfactory results so long as the remaining tumor is removed as far as possible by electrocoagulation Following this radon seeds or radium needles are implanted alongside the pterygoid plate to control tumor tissue which remains Best results are obtained by following this extensive treatment by external irradiation

One such case (Fig 28-4) in the author s series with extensive disease of the maxillary sinus destruction of the posterior wall of the *maxillary sinus and marked involvement of* the pterygomaxillary fossa responded well to treatment and remained free of disease for over 5 years The defect of the maxilla and hard palate resulting from resection of the maxilla is satisfactorily taken care of by a properly fitting prosthesis which allows the patient to speak and eat normally

The treatment of carcinoma of the ethmoid sinuses as well as the less common lesions of the frontal and sphenoid sinuses is most often a combination of surgery and radiation therapy Depending upon the size and location of the lesion various surgical approaches are available At times when dealing with what appears to be a very extensive and bulky malignancy of the ethmoid labyrinth after confirming the diagnosis by a biopsy occasionally x ray therapy given prior to surgery may shrink the lesion and make it more suitable for complete or partial surgical removal Even though surgery is carried out on most lesions of the ethmoid sphenoid and frontal sinuses additional treatment in the form of radium or radon seeds left in the cavity at the time of operation is indicated as well as heavy fractional external radiation postoperatively Very few lesions of the middle turbinate or ethmoid area even though small should be approached intranasally The most common and most satisfactory approach for most lesions of the turbinates

treatment of carcinoma of the temporal bone has given poor results These lesions carry a grave prognosis and are apt to progress rapidly, cause widespread destruction in the temporal bone, and quickly invade the meninges and brain X ray therapy alone has not been encouraging More recently the possibility of temporal bone resection followed by radiation therapy has offered some hope

THE UPPER RESPIRATORY TRACT

Except for malignant disease, changes in the character of the upper respiratory tract which are particularly associated with increasing age are likely to be less disabling than those encountered in other areas of the body and other organs The conditions of the nose and throat, aside from malignant disease which can be associated primarily with increasing age are relatively few and result mainly from atrophic changes of the mucous membrane, the mucous glands and associated muscles These changes naturally are aggravated or accelerated by the presence of the various irritants in the inspired air and the environmental conditions under which the person lives Changes in the upper respiratory tract are influenced by increasing age The various atrophic changes inflammatory changes, and even metaplasia of the upper respiratory tract epithelium may be influenced adversely by excessive smoking and exposure to industrial dust and fumes as well as by living in an overheated and relatively dry atmosphere

As a general rule, infectious sinus disease tends to give less trouble in increasing age as a result of improved drainage and ventilation resulting from atrophy and to some extent fibrosis of the nasal mucous membrane Then for practical purposes the most common and most important problem facing the otolaryngologist in the aging patient is the diagnosis and treatment of malignant disease of the upper respiratory tract

Cancer of the Nose and Paranasal Sinuses

Malignant tumors may arise from the nasal cavity or from any of the sinuses In the nose they most frequently arise from the nasal septum or high on the lateral wall of the nasal passage Lesions on the anterior part of the septum particularly if there is ulceration should always be regarded with suspicion and a biopsy taken When malignant tumors arise in the sinuses the maxillary sinus is most commonly involved in the proportion of approximately 5 1 Most antral cancers develop between the ages of 55 and 70 Primary carcinoma of the ethmoid



Fig 28 4 Male age 62 first print showing a bulky tumor mass with ulceration protruding from the right first upper molar tooth socket Mass appeared approximately 6 months following extraction of the tooth for severe pain Examinations revealed a moderately anaplastic epidermoid carcinoma involving the right maxillary sinus with destruction of the posterior wall of the sinus and invasion of the pterygomaxillary fossa Other two prints show the postoperative defect and prosthesis for correction of defect following resection of the maxilla

labyrinth is the next most frequent sinus cancer and occurs usually in the fourth and fifth decades The frontal sinus may be involved and least frequently the sphenoid sinus

The majority of malignant tumors of the paranasal sinuses are squamous cell carcinomas arising from the mucous membrane lining the cavities Squamous cell carcinomas make up approximately 60 to 65 per cent of malignant tumors arising in this area Various types of sarcomas and some undifferentiated epidermoid carcinomas with cell types not classified and adenocarcinomas make up the remaining 30 to 35 per cent

One of the most common and often early symptoms of cancer of the nose and paranasal sinuses is an unexplained dull persistent pain about the face which is usually worse at night or when lying down Bleeding is a frequent but usually late sign Many malignant tumors of the nose and paranasal sinuses become ulcerated and infected Nasal obstruction usually unilateral may be the only symptom In the presence of persistent unilateral nasal discharge or bleeding cancer should be suspected particularly in the older age group In such patients x ray films of the sinuses should always be taken as they may show evidence of destruction at a relatively early stage of disease particularly if the maxillary sinus is involved

Treatment

Considerable progress has been made in the treatment of cancer of the paranasal sinuses since 1935 In general at the present time cancer of the paranasal sinuses particularly of the maxillary sinus is treated either by wide surgical excision or by a combination of surgery and radiation therapy The cardinal principle of treatment is that the affected sinus must either be resected or else opened widely with removal of all of the tumor or as much as possible with or without electrocoagulation Usually at the end of the operation radium or radon seeds are applied locally Routinely this is followed by external irradiation

When the maxillary sinus alone is involved resection of the maxilla consistently gives the best results Even though the disease has involved the posterior wall of the maxillary sinus and has extended into the pterygomaxillary fossa resection of the maxilla may still give satisfactory results so long as the remaining tumor is removed as far as possible by electrocoagulation Following this radon seeds or radium needles are implanted alongside the pterygoid plate to control tumor tissue which remains Best results are obtained by following this extensive treatment by external irradiation

One such case (Fig 28-4) in the author s series with extensive disease of the maxillary sinus destruction of the posterior wall of the maxillary sinus and marked involvement of the pterygomaxillary fossa responded well to treatment and remained free of disease for over 5 years The defect of the maxilla and hard palate resulting from resection of the maxilla is satisfactorily taken care of by a properly fitting prosthesis which allows the patient to speak and eat normally

The treatment of carcinoma of the ethmoid sinuses as well as the less common lesions of the frontal and sphenoid sinuses is most often a combination of surgery and radiation therapy Depending upon the size and location of the lesion various surgical approaches are available At times when dealing with what appears to be a very extensive and bulky malignancy of the ethmoid labyrinth after confirming the diagnosis by a biopsy occasionally x ray therapy given prior to surgery may shrink the lesion and make it more suitable for complete or partial surgical removal Even though surgery is carried out on most lesions of the ethmoid sphenoid and frontal sinuses additional treatment in the form of radium or radon seeds left in the cavity at the time of operation is indicated as well as heavy fractional external radiation postoperatively Very few lesions of the middle turbinate or ethmoid area even though small should be approached intranasally The most common and most satisfactory approach for most lesions of the turbinates

lateral nasal wall, and ethmoids is the lateral *rhinotomy* or Moure s operation The typical incision of the lateral rhinotomy is made from the inner extremity of the eyebrow, de scending to the side of the ala nasi but not entering the vestibule of the nose If neces- sary the incision may be extended upwards in the plane of the eyebrow and/or may be continued around the nose inferiorly to the midline to split the upper lip in the midline The periosteum can be easily elevated from the nasal bones the ascending process of the maxilla, and the nasal process of the frontal bone As much of the nasal bone and ascend- ing process of the maxilla or nasal process of the frontal bone may be resected as is necessary to give the required exposure The second common approach is the transan- tral where a gingivobuccal incision is made, similar to that of the Caldwell Luc incision The mucoperiosteum over the front face of the maxilla is elevated the maxillary sinus is entered through the canine fossa and as much of the frontal face removed as is nec- essary The entire nasoantral wall can be re moved where necessary thus giving an ex cellent exposure of the entire sphenoethmoid areas At times it is advantageous to combine the transantral approach with a limited lat eral rhinotomy In lesions of the ethmoid rarely is it necessary to resect the maxilla to obtain the desired exposure The lateral rhinotomy approach to the paranasal sinuses and the nasopharynx was recommended by Michaux in 1853 and by other surgeons It was fully described by Moure, of Bordeaux

In small lesions of the ethmoid labyrinth, particularly when the lesion arises from the middle turbinate, it is advisable and usually possible to remove the involved section of the turbinate and ethmoid labyrinth *en bloc* in order to avoid seeding of the lesion In most cases the entire nasoantral wall is re- moved and the ethmoid cells thoroughly ex enterated so that the single converted cavity can be well visualized postoperatively

Perhaps more progress has been made in the treatment of cancer of the paranasal sinuses than in most lesions of the upper respiratory tract Formerly these lesions were treated primarily by x ray therapy and sur gery was used only as an adjunct for drainage or removal of sequestra The results have improved by approximately 100 per cent since the primary surgical approach has been adopted with the use of radium and x ray therapy as an adjunct either preoperatively or postoperatively In 1935 Gordon B New reported that 40 per cent of some 30 patients with carcinoma of the maxillary sinuses treated for primary antral malignancy and followed for a period of 5 years or more were found free of disease after 5 years In 1955 Edgar L Frazell reported that a follow up study from the Head and Neck Service of Memorial Hospital showed a 5 year cure rate of 15 per cent in patients with epider moid carcinoma of the maxillary sinus when they were treated principally by irradiation as contrasted with 30 per cent 5 year cures during the latter years when surgery was the principal or primary mode of treatment He also reported a similar, but less spectacular, improvement (20 per cent versus 33 per cent) in the cures of patients with epider moid carcinoma of the ethmoid sinuses He stated that the latter series was small and possibly not statistically significant

Cancer of the Nasopharynx

Malignancy of the nasopharynx may de velop in any age group However the highest incidence occurs in the fourth and fifth dec ades When compared with carcinoma of the larynx or carcinoma of the paranasal sinuses and most malignancies of the upper respira tory tract cancer of the nasopharynx occurs in an earlier age group Approximately 20 per cent of nasopharyngeal malignancies are found in patients under 30 years of age When various groups of cases are analyzed the greatest percentage of cases appear to center around the mean age of 43 to 45 years As with most lesions of the upper respiratory tract carcinoma of the naso pharynx occurs most commonly in the male in the ratio of approximately 3 1 In this country cancer of the nasopharynx appears

to constitute approximately 2 per cent of all malignant growths that are seen In China the disease is relatively common accounting for approximately 5 per cent of all cancers

The lesion most commonly arises on the posterior wall to either side of the midline of the nasopharynx or else in the area of the fossa of Rosenmueller In the early cases the symptoms are usually unilateral In approximately 50 per cent of cases the first sign of the lesion is an enlarged cervical lymph node Metastatic nodes appear at some time during the course of the disease in approximately 75 to 80 per cent of cases Another early sign is unilateral hearing impairment or ear symptoms suggesting acute or chronic secretory otitis media Other signs and symptoms suggesting carcinoma of the nasopharynx are unilateral nasal obstruction occasionally with bleeding impairment of vision paralysis of the extraocular muscles involvement of the third to sixth cranial nerves Frequently the sixth cranial nerve is the first involved Characteristically the lesion extends upward to involve the structures at the base of the skull During the later stages the so called *jugular bulb syndrome* with paralysis of the ninth tenth eleventh and twelfth cranial nerves is encountered

Cancerous growths of the nasopharynx are among the most malignant in type of those seen in the upper respiratory tract Seventy to eighty per cent of the malignant lesions are carcinomas of which approximately 80 per cent are more or less undifferentiated carcinoma Sarcoma accounts for approximately 15 to 20 per cent and adenocarcinoma for approximately 2 to 3 per cent The most common cell types seen are the transitional cell carcinomas the lymphoepitheliomas the squamous cell carcinomas and the undifferentiated and unclassified carcinomas

Prognosis

Various series report from 22 to 25 per cent 5 year cures The poorest results are reported in the young and elderly age groups As to cell type the lymphoepitheliomas carry the highest rate of 5 year cures and the squamous cell carcinomas appear to carry the lowest In one series of cases the average duration of symptoms prior to diagnosis was 1 year However as more physicians become cancer conscious many cases are being picked up much earlier and before metastatic nodes are palpable In this respect it is important that all patients in the middle and older age group with ear symptoms suggestive of a lesion of the nasopharynx should have a careful nasopharyngeal examination by both mirror posterior rhinoscopy and the nasopharyngoscope If the lesion is diagnosed prior to the appearance of metastatic nodes the chance of a 5 year survival is definitely improved

Treatment

The treatment of nasopharyngeal malignancy is primarily by x ray therapy Since these tumors metastasize early to the upper cervical nodes they should receive external irradiation whether neck nodes are palpable or not In patients with large metastatic cervical nodes the radiation therapy is supplemented by the implantation of radon seeds or the application of radium needles In patients with squamous cell carcinoma of the nasopharynx where the primary tumor has been controlled by x ray therapy the metastatic nodes can be dealt with by radical neck dissection which may also be indicated in certain other cell types where the metastatic nodes do not regress with x ray therapy

Cancer of the Oropharynx

Carcinoma is the most prevalent the most important and the most dangerous disease occurring in the mouth of the aging patient It is also more curable in the older than in the younger age group Therefore every effort should be made by the physician and the dentist to diagnose these lesions early

Cancer of the Lips

Over 50 per cent of cases of cancer of the lip occur in individuals in the sixth decade



Fig 28 5 Male age 48 showing fungating lesion arising from the left lower first molar tooth socket following extraction of the tooth for severe pain Biopsy showed a transitional cell carcinoma Patient was treated by wide surgical excision combined with hemiresection of the mandible and supradigastric neck resection Patient was free of recurrence 6 years later and finally succumbed to an entirely different lesion at another site

or older Twenty five per cent of all cases of cancer of the lip occur in individuals over 70 years of age It should be pointed out at the same time however that cancer of the lip occasionally occurs in the second decade Cancer of the lip is predominantly a disease of the male Approximately 97 per cent of all cases occur in the male This is also true of carcinoma of the larynx Carcinoma of the lip should be the easiest of all carcinomas to diagnose because of its location

Treatment

For practical purposes all carcinoma of the lips is of the squamous cell type If the lesions are under 1 5 to 2 cm in diameter and are superficial, they can be treated by a V-shaped excision taking care to excise a minimum of 1 cm of normal tissue as a margin Such treatment should cure 95 per cent of these patients Also experience in the past has taught that x ray therapy has cured a large percentage of these patients Larger lesions require careful evaluation to ensure complete excision, and if nodes are present unilateral or bilateral suprahyoid neck dissection should be carried out as indicated In some of the larger lesions even without palpable submental or submaxillary nodes, a prophylactic suprahyoid neck dissection is indicated

Various types of carcinoma arise from the gums the mucous membrane of the cheek the palate fauces and pharynx However space permits only a discussion of several of the more common and more important lesions

Carcinoma of the Alveolus and the Mandible

In the mouth carcinoma involving the alveolus or the mandible by secondary extension is relatively common in the older age group These lesions are apt to follow long standing leukoplakia infection, or irritation about the teeth and all too frequently they appear only several months after a tooth extraction These lesions tend to be of relatively low malignancy and to fungate outwardly from the tooth socket or area of irritation When the lesion involves the mandible (Fig 28 5) x ray therapy is hazardous because adequate dosage applied to the lesion will frequently cause radionecrosis, which will be followed by a protracted illness associated with intense pain Therefore surgical treatment is preferred for these lesions particularly the fairly sizable ones which can be dealt with quite satisfactorily by hemiresection of the mandible along with the wide excision of the lesion and adjacent mucous membrane usually a suprahyoid or a classical neck dissection is performed as indicated These same lesions when occurring in the alveolus may in neglected cases

extend into the maxillary sinus with eventual destruction of the posterior wall of the sinus and invasion of the pterygomaxillary fossa They are best treated by resection of the maxilla and any extension of the lesion in the pterygomaxillary fossa is treated by radon seeds or radium needles In such cases routine external irradiation is indicated

Cancer of the Tongue

Carcinoma of the tongue is seen more frequently in men than in women in the ratio of approximately 6 1 or 7 1 The most common site is along the lateral border of the middle third The lesion occurs on the base of the tongue or in the posterior third more frequently than on the anterior third

According to Martin Munster and Sugarbaker cancer of the tongue constitutes approximately 15 per cent of all tumors of the upper respiratory and the alimentary tracts and about 25 per cent of all intraoral tumors The same writers estimated that cancer of the tongue is most common in the sixth decade although it frequently occurs in the fifth and seventh

Treatment

Small carcinomas of the tip and dorsum of the tongue are more apt to be of the low grade squamous cell type and if the lesions are small wide local excision or x ray therapy by means of the intraoral cone usually gives satisfactory results Larger lesions of the tip of the tongue or lateral border of the tongue usually will require hemiglossectomy with complete neck dissection along with excision of the involved mandible en bloc if it is involved Lesions of the base of the tongue are more apt to be highly anaplastic and in approximately 20 per cent of cases they are of the transitional or lymphoepithelioma cell type These lesions are apt to be bulky and frequently extend beyond the midline of the tongue and are problems in treatment The primary lesion is usually treated with x ray therapy supplemented by radium needles, and the metastatic nodes are treated by radical neck dissection

Cancer of the Tonsil

In 1928 Ewing stated that 10 per cent of all buccal cancer occurred in the tonsil The disease is much more common in men than in women and the majority of cases occur in the fifth and sixth decades of life

Either carcinoma or sarcoma may occur in the tonsil Carcinoma of the tonsil is usually of the less differentiated types of grade 2 or 3 similar to those occurring in the nasopharynx The transitional cell type is also common Of the sarcomas the lymphosarcoma is the more common The lymphoepithelioma occurs less frequently in the tonsil and is similar to those in the nasopharynx

Quite frequently the carcinomas occurring in the tonsil may be differentiated clinically from the sarcomas The carcinoma usually appears as an infiltration with a hard edge and ulcerates early The lesion later spreads to the fauces or palate It usually has an indurated margin and is hard to the touch The lymphosarcoma on the other hand causes considerable enlargement of the tonsil usually without ulceration in the early stages It may occur in both tonsils simultaneously Occasionally a lymphosarcoma of the tonsil or lateral pharyngeal area will be mistaken for a peritonsillar abscess

Symptoms

In the early stages carcinoma of the tonsil is without symptoms Later as the lesion extends to the tonsillar pillars and base of the tongue difficulty in swallowing and pain radiating to the ear occur As the growth progresses there is a feeling of fullness more pain excessive mucus and frequent bleeding Approximately 40 per cent of patients with carcinoma of the tonsil show an enlarged firm tonsillar node when first seen

Treatment

The treatment of a primary tonsillar growth is usually by x ray therapy with use

of a combination of the intraoral cone and fractional external radiation In suitable cases, the metastatic nodes are treated by radical neck dissection However owing to the type of lesion or the nature of the metastasis, radical neck dissection is not feasible in many cases The author's best results have been obtained where he has been able to destroy the tonsillar lesion and tonsil by irradiation, using a combination of the intraoral cone and external radiation and has carried out a radical neck dissection following x-ray therapy In many cases, the lesions are bulky when first seen The patient may have trismus and the intraoral cone may not be usable Also many cases have bulky metastatic nodes with fixation and external irradiation must be supplemented by radium needles or radon seeds as a palliative procedure

Prognosis

In general, carcinoma of the tonsil carries a 20 to 35 per cent 5 year cure rate Lymphoepithelioma, although the most radiosensitive of the group gives the poorest prognosis Transitional cell carcinoma and lymphosarcoma carry a more favorable prognosis than squamous cell carcinoma of the tonsil Patients who have cervical metastases at the time they are first seen or who develop metastases during treatment carry the poorer prognosis

Cancer of the Larynx

In the aging patient, cancer of the larynx is a common condition The surgical treatment of cancer of the larynx makes up the vast majority of surgical procedures on the larynx in this age group Cancer of the larynx constitutes approximately 50 per cent of all cancers of the upper respiratory tract In the over all picture of cancer cancer of the larynx makes up approximately 3 per cent of all malignant tumors At least 95 per cent of all cases of carcinoma of the larynx occur in the male This disease is primarily a disease of the aging Only about 2 per cent of malignancies of the larynx occur under 40 years of age Approximately 90 per cent of the patients with cancer of the larynx are 40 years of age or more, and around 75 per cent of the cases occur in patients over 50 years of age Approximately 50 per cent of cases of carcinoma of the larynx occur in individuals 60 years of age and older, and about 9 per cent in individuals age 70 or older

Pathology

Squamous cell or epidermoid carcinomas make up the vast majority of malignant lesions of the larynx Of all laryngeal cancers approximately 96 per cent are squamous cell carcinomas or epitheliomas Adenocarcinomas account for approximately 2 per cent of malignant lesions of the larynx and sarcomas approximately 1 per cent Basal cell carcinoma of the larynx is extremely rare however, when it does arise in the larynx it is very malignant

In general carcinoma of the epiglottis the aryepiglottic folds, and postcricoid area are more highly malignant and individual cells less differentiated

Symptoms

The early symptoms of cancer of the larynx depend entirely upon the point of origin of the growth The function of the intrinsic larynx has to do mainly with voice production and respiration Therefore a very small lesion of the vocal cord will interfere with phonation and produce hoarseness whereas a considerable growth may be obtained before dyspnea is produced Hence for practical purposes hoarseness is the first symptom of intrinsic carcinoma of the larynx Unexplained hoarseness of over 3 weeks duration particularly in the age group of 40 years and over is presumed to be due to cancer until proved otherwise The structures of the extrinsic larynx have to do mainly with the function of swallowing A tumor may reach

a fairly large size in this part of the larynx and infiltrate deeply before producing pain and difficulty in swallowing which are usually the first symptoms of involvement of the extrinsic larynx For practical purposes slight pain or difficulty in swallowing are the first symptoms of extrinsic cancer of the larynx in about half the cases Dyspnea is an early symptom in some cases where the condition is fairly advanced In about 20 per cent of cases the first sign of the lesion is the appearance of enlarged cervical lymph nodes in the region of the carotid bulb Hoarseness is the first symptom of extrinsic carcinoma of the larynx in a relatively small percentage of cases

Diagnosis

The early diagnosis of carcinoma of the larynx is of the utmost importance The importance of early diagnosis is emphasized by the fact that approximately 95 per cent of cases can be cured either by surgery or by irradiation if a carcinoma of the vocal cord is diagnosed early before it reaches a diameter greater than 1 cm and before it has invaded the underlying structures with fixation or has involved the anterior commissure When the lesions are diagnosed later after involvement of the anterior commissure extension to the opposite vocal cord or invasion of surrounding tissues with fixation of the vocal cord the 5 year percentage of cures drops rather sharply

Treatment

For best results in the treatment of cancer of the larynx each case must be carefully evaluated and the type of treatment selected on the basis of the individual case

In the so called intrinsic carcinoma of the larynx where the vocal cord is involved the lesion is no greater than 1 cm in diameter the anterior commissure is not involved and the cord is freely movable suggesting that the lesion is superficial and has not invaded the underlying tissues the treatment of choice is laryngofissure with removal of the anterior commissure tendon the vocal process on the involved side and as much of the tissue adjacent to the cord as is necessary to insure complete removal of the lesion Such treatment will cure approximately 95 per cent of these lesions It is only fair to point out that x ray therapy when properly given will also give a high percentage of 5 year cures in this type of cordal cancer In more extensive intrinsic carcinoma or cordal cancer where the affected cord is fixed or where the lesion has extended into the anterior commissure and involves the opposite cord laryngectomy is the treatment of choice care being taken to remove the entire supraepiglottic space along with the prelaryngeal lymph nodes The sternothyroid and the thyrohyoid muscles are removed en bloc with the larynx to insure removal of the prelaryngeal lymph nodes If cervical nodes are present a radical neck dissection is combined with the laryngectomy In extrinsic carcinoma of the larynx with involvement of the tip or posterior surface of the epiglottis the inner surfaces of the aryepiglottic folds or the arytenoids total laryngectomy usually the so called *wide field procedure* is indicated Cervical metastases are dealt with by radical neck dissection on the involved side and if they are bilateral the radical neck dissection on the second side is usually done after 6 weeks to 3 months In many of these patients with metastatic lesions external irradiation is used to supplement the treatment depending upon the cell type and the location of the lesion

In carcinoma of the vocal cord where the lesion is larger than 1 cm and has extended into the anterior commissure experience has shown that it is unwise to treat the patient by laryngofissure alone If fixation of the cord is not present the patient may be given x ray therapy and then if the lesion fails to respond a laryngectomy should be performed However if fixation of the vocal cord is present a laryngectomy is usually indicated In general it is doubtful that any case of carcinoma of the larynx with fixation of the

vocal cord or vocal cords ever should be treated primarily by x ray therapy

In bulky lesions of the intrinsic larynx particularly where there is deep infiltration of the underlying tissues and where cartilage is involved, laryngectomy should be done where possible combined with a radical neck dissection After the larynx with its cartilaginous structures has been removed the surgical treatment can be supplemented by x ray therapy with more adequate dosage than could be given with the larynx in place for fear of destruction of the laryngeal cartilages with resulting laryngeal obstruction pain and the usual distressing syndrome which follows x ray therapy under these conditions

In bulky lesions of the extrinsic larynx with cervical metastases either unilateral or bilateral, where the patient may be deemed inoperable at the time he is first seen x ray therapy may be given and if the lesion regresses sufficiently a laryngectomy and combined radical neck dissection may become feasible

BIBLIOGRAPHY

Cawthorne T E Menieres Disease Ann Otol Rhin & Laryng 56 18 1947
Dandy W E The Surgical Treatment of Menieres Disease Surg Gynec & Obst 72 421 1941
Day K M Surgical Destruction of the Labyrinth for Menieres Disease Laryngoscope 62 547 1952
Ewing J *Neoplastic Disease* 3d ed W B Saunders Company Philadelphia 1931
Frazell E L Cancer of the Paranasal Sinuses Tr Am Laryng Rhin & Otol Soc 1955 p 351
Martin H E Munster H and Sugarbaker E Cancer of the Tongue Arch Surg 41 888 1940
Miller D Cancer of the External Auditory Meatus Tr Am Laryng Rhin & Otol Soc 1955 p 421
New G B and Cabot C M Curability of Malignant Tumors of the Upper Jaw and Antrum Surg Gynec & Obst 60 971 1935
Rosen S Chorda Tympani Nerve Section and Plexectomy Arch Otolaryng 50 81 1949
Schall L A Neoplasms Involving the Middle Ear Arch Otolaryng 22 548 1935

Part 8

Trauma and Reconstructive Surgery

29

Tiauma

Preston A Wade and Paul W Braunstein

Although the aged person is not subject to as many types of trauma as the younger adult who may be active in vigorous sports or employed in a dangerous type of work nevertheless he is subject to the trauma which results from the increasing number of auto mobile accidents in this country Therefore we may expect to see a considerable number of elderly persons with severe and multiple injuries as well as a large number who sus tain severe injuries as the result of relatively minor trauma which would not cause a dis abling injury in a younger person Because of predisposing factors the elderly person is much more likely to sustain an injury as the result of a minor trauma

PREDISPOSING FACTORS

There are many physical infirmities which lead to slips and falls with their resulting disabilities Among these are poor hearing and poor eyesight which make it difficult for persons in this age group to avoid the usual minor obstacles which the healthy person avoids instinctively Many aged persons have a mental aberration usually the result of cerebral arteriosclerosis which impairs their judgment and exposes them to unnecessary and serious accidents

Furthermore the aged person has weak ened and easily fatigued muscles and his re flexes are sluggish so that he is slow to react to changes in situations Because the aged person is often subject to disability of joints he is unable to walk easily and carefully over the normal steps and obstacles that do not interfere with a younger person

The aged person is much more subject to fractures than to soft tissue injury as a re sult of minor trauma because the structure of the bone in the elderly person is different from that in the normal healthy young adult The apposition of new bone fails to keep pace with the normal osteoplastic re sorption and osteoporosis develops in old age since there is a general retardation of cellular proliferation Replacement of the outlived osteocytes demands resorption of surrounding bone and this goes on while osteoblastic apposition of new bone fails Thus the bone trabeculae become progres sively thinner fat content increases and the cortex becomes thin The bone of the elderly person is therefore much more fragile than that of the normal young healthy adult and the thinness of the cortex makes it more susceptible to stresses strains and leverage forces Furthermore many aged persons are subject to arthritis or other joint disabilities which cause limitation of motion in the joints and unnatural strain and leverages may cause fractures of the fragile bone ad jacent to the joint The most common trau matic lesion to which the aged person is sub ject is a fracture and the aged female is much more susceptible than the male

On the fracture service of The New York Hospital–Hospital for Special Surgery—in 1956 there were 336 patients over the age of 60 treated for fractures Of these 240 were females and 96 were males Fractures of the

hip were the most common about 30 per cent of the entire series while Colles fractures and fractures of the humerus, particularly of the upper third, made up another 30 per cent of the series The remainder was fairly evenly divided among fractures of the tibia, ankle, femur pelvis, and vertebrae with a small number of fractures of other regions

Bick found in a study of 516 cases of fractures and dislocations occurring among the elderly at the Mount Sinai Hospital, New York that fractures occurred four times more frequently in females than in males and that there was a very definite pattern of distribution of sites involved, similar to that in The New York Hospital

GENERAL TREATMENT

The treatment of traumatic conditions in the elderly is considerably more difficult and more complicated than in the younger person The general principles of the care of any single traumatic lesion in the elderly are similar to those for the care of the younger person, but because of the difference in the type of protoplasm involved, the details of the treatment must necessarily be considerably different Because one or more important systems of the aged person are usually affected by some degenerative disease the treatment of the traumatic condition may become secondary to the aggravation of a preexisting pathologic condition which was not serious or disabling before the accident occurred but which immediately thereafter may become serious and even potentially fatal The treatment of the elderly patient who has sustained an injury is therefore usually a combination of the treatment of the injury and of a serious preexisting debilitating disease

FIRST AID

Since the elderly patient has little reserve to withstand the results of injury first aid care may prove to be a deciding factor in the outcome of the case

Open Airway

Unobstructed respiration is essential for survival and the elderly patient tolerates anoxia poorly It is therefore necessary that all obstruction to breathing be removed as soon as possible at the site of the accident Mucus, blood, and vomitus must be removed from the mouth and pharynx If there has been an injury to the face and jaws so that the tongue falls back and obstructs the pharynx, it must be pulled forward This may be done by attaching a string to a clamp or a safety pin inserted through the tip of the tongue and tying the tongue to the clothing thus holding it forward for a considerable period

Open (sucking) wounds of the chest should of course be covered and closed immediately by means of any clean cloth available

Control of Hemorrhage

Hemorrhage should be controlled by pressure dressings over the bleeding area The use of the tourniquet is contraindicated particularly in the aged If applied too loosely the tourniquet increases venous hemorrhage if applied tightly enough to stop arterial bleeding it will usually cause damage to the circulation of the limb distal to the point of application of the tourniquet Elderly persons are frequently victims of arteriosclerosis and do not tolerate pressure on large arteries well therefore serious circulatory damage may be produced through the use of a tourniquet

Treatment of Shock

There is very little that can be done at the site of the accident to treat shock but there are certain important things that may be done to help prevent it or to decrease its severity The patient must be handled carefully and gently Hemorrhage should be controlled by pressure bandages The patient

A

B

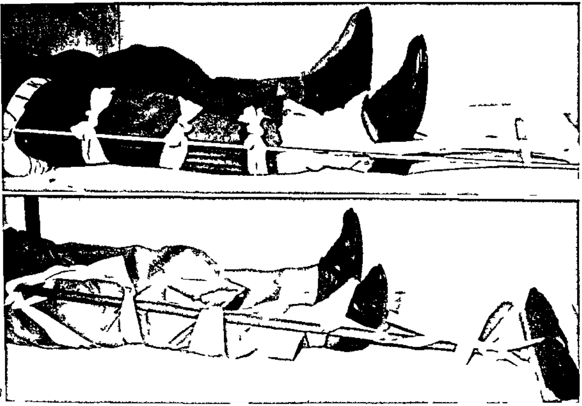


Fig 29 1 *A* Conventional half ring Thomas splint for traction splinting of hip and femoral fracture *B* Makeshift traction splinting with use of broom stick slings and Spanish windlass maneuver for traction

should be covered to protect him from the elements The application of external heat is unnecessary and it is unwise to give stimulants All limbs suspected of being fractured should be splinted and the patient should be transported carefully and with no more speed than is necessary to get him to a hospital for definitive care in a reasonable length of time

Splinting of Fractures

It is necessary to splint all limbs that are fractured or suspected of being fractured The simplest and most available types of splinting should be taught to all people interested in first aid It is necessary to transport a patient with a suspected spine injury on a flat surface without flexing the spine The upper extremity may be splinted by means of simple bandaging to the chest wall The arm may also be splinted by means of a board bandaged to the extremity It is unnecessary and unwise to use traction splints on the upper extremity because of the danger of injury to axillary structures The forearm may be splinted by means of a board cardboard or magazine and the limb suspended in a sling

The lower extremity may be splinted by several different methods A fracture of the hip is most common in the elderly person If a Thomas splint (Fig 29 1*A*) is available and if it can be applied without undue discomfort and pain to the patient it is the preferred method of splinting Sometimes a patient can more easily be transported by merely mummifying him in blankets and carrying him on a flat stretcher

A simple type of traction splint is provided by a board about 2 ft longer than the extremity and two slings A sling is applied to the upper portion of the leg at the groin and the stick or board is inserted into the free loop of the sling A second sling is tied



Fig 29 2 The pillow board splint for *fractures involving knee ankle or leg*

at the ankle of the affected limb and tied over the end of the board Traction may be obtained by a Spanish windlass maneuver of this sling The leg may then be bound to the board with any available cloth and the patient easily transported (Fig 29 1*B*)

There is considerable difference of opinion *as to whether all actual or suspected* fractures of the hip should be splinted in a Thomas splint with traction It seems unnecessary to insist that this be done in every case since the application of the splint may cause more disturbance and more motion at the fracture line than transportation on a stretcher with the patient wrapped in blankets

For fractures of the knee and lower leg the pillow board splint, as illustrated in Fig 29 2 will give satisfactory immobilization with least difficulty in application

Administration of Morphine

Morphine should not be administered to an elderly patient at the scene of the accident particularly if he is in shock unless he is in very severe pain Any medication which is administered should be recorded on a paper accompanying the patient to the hospital where he is to receive definite care If morphine is given to a patient who is suffering from shock the intravenous route of administration should be employed

ACCIDENT ROOM CARE

When the patient arrives in the accident room he should immediately be seen by a competent surgeon and a complete examination made to assess the nature of the major injuries and the extent of secondary injuries Vital signs should be observed and recorded particularly the blood pressure pulse respiration and state of consciousness A urine examination must also be made An attempt at voiding should be permitted and if the patient cannot void a catheter should be inserted and should be left in place for further and repeated urine examinations

Frequently the elderly person will arrive in the emergency room in a hypotensive state It is always of extreme importance to determine whether this hypotension is caused by cardiovascular shock (coronary occlusion) or acute blood loss either into the

muscle planes about a fracture site or into the peritoneal cavity or lumen of the gastro intestinal tract or external such as the loss noted in an open fracture Immediate observations must be frequent and must include determinations of blood pressure pulse and state of consciousness One must remember that hypotension of any degree can lead to relative myocardial ischemia or to cerebrovascular ischemia and to rapid death of the patient from these two types of relatively arrested circulation of blood Upon the patient s arrival in the emergency room typing and cross matching must be carried out and a needle placed into a patent vein as soon as this can be accomplished after preliminary physical examination Plasma expanders are certainly more desirable than glucose in water glucose in saline, or normal saline If there are no plasma expanders available it is probably wiser to administer normal saline until such expanders can be obtained Dextran must be used sparingly because of the possibility of creating a temporary bleeding diathesis after administration of more than two units Plasma or albumin may be used but one must remember that plasma expanders without red blood cells do not afford the patient the oxygen-carrying capacity of hemoglobin Therefore whole blood is preferred because of its colloidal properties and because of its oxygen carrying capacity This is especially true in an old person where relative ischemia in any of the peripheral organs may prove disastrous Another important consideration in the use of plasma expanders or blood is the inelasticity of the older person s cardiovascular system Because this inelasticity of vessels prevents extracellular fluid space expansion the patient will not tolerate fluid overloading to any degree The hematocrit reading is of little value in the early period following the injury The hematocrit will not change until hemodilution has occurred in the first 24 to 48 hours Therefore one must depend upon the assessment of the degree of shock by use of the blood pressure and pulse rather than by the use of hematocrit or blood cell counts Again one should not try to return an aged person s hematocrit to a normal level immediately following injury primarily because the patient may not have possessed a normal hematocrit prior to injury due to a chronic state of anemia Secondly the older person may not tolerate replacement therapy with the use of large volumes of whole blood A satisfactory circulatory status will be obtained usually with the hematocrit at a lower level than that which would be expected under normal conditions For example if one suspects that the older person s hematocrit would normally be between 38 and 40 suitable blood replacement will effect a return of the hematocrit to a range of 33 to 35 rather than to the previous 38 to 40

Although Levophed and other vasopressor substances have been advised in the treatment of shock the authors believe that this is contraindicated in the elderly person particularly when the shock is due to injury or loss of blood

In the accident room while assessing and treating shock any obstruction to the respiration should be removed immediately and mucus blood and vomitus sucked free of the larynx If there are injuries to the chest such as multiple fractures causing paradoxical respiration a tracheostomy may be necessary but this should be done in the operating room if possible and not as an emergency procedure in the accident room Great care should be taken that the proper sized tube is inserted so that it is long enough and large enough to be efficient in maintaining proper oxygen exchange The care of the tracheostomy tube will be discussed later

If there is hemorrhage it should be controlled by means of a pressure dressing and not by a tourniquet If a tourniquet is in place at the time the patient is admitted to the hospital and if the bleeding has continued the tourniquet should be removed since the bleeding must necessarily be venous If the tourniquet is in place and there is no bleeding the patient should be prepared for blood transfusions and other

treatment before the tourniquet is removed, since the sudden removal of a tourniquet on an injured limb may send the elderly patient into immediate and possibly fatal shock

Radiographic examinations should be obtained of all suspected areas of injury and should be performed as carefully as possible in the accident room Patients should not be transferred from one stretcher to another just to facilitate x-ray examination If there is suspected spine injury, it may be necessary to take all x ray films, even of the chest and lungs, in the supine position It is not necessary to obtain a lateral view of a fracture of the neck of the femur in the accident room for the anteroposterior view will usually give the diagnosis in sufficient detail to allow the surgeon to decide upon the course of treatment A lateral roentgenogram can be taken at a time when less harm may be done to the fracture site and surrounding capsule and vessels

Roentgenograms of the skull are usually unnecessary in the accident room and are seldom of sufficient quality to be of diagnostic significance It is therefore wiser to delay radiologic examination of the skull until the patient s condition has stabilized

Any chest injury must be recognized and treated as soon as possible The open (sucking) wound of the chest should of course, be closed immediately by the application of Vaseline gauze and pressure dressing Tension pneumothorax or increasing hemothorax can be recognized by examination and radiography and the area decompressed by needle aspiration or if needle aspiration is unsuccessful by means of closed thoracotomy with drainage under water

Since the aged person may be fragile with delicate balance of his physiologic processes it is essential that he be observed carefully in the accident room before he is moved either to the operating room or to his bed Proper evaluation and treatment of injuries or early complications during the first few hours may prove lifesaving During this period frequent abdominal examination is necessary if intraabdominal injury is suspected There is considerable difference of opinion as to whether or not abdominal puncture is wise for the diagnosis of abdominal injury but it is certainly true that, when positive, the abdominal puncture is helpful in diagnosing intraabdominal hemorrhage or hollow viscus perforation A negative tap may be misleading

OPEN WOUNDS AND OPEN FRACTURES

Open wounds and open fractures should be treated immediately and debridement properly performed in an operating room If there are other severe injuries or serious complications which preclude immediate operation it may be necessary to compromise and wait for hours until the patient is in the proper condition for the operative procedure If the condition of the patient is such that operation cannot be performed within a reasonable time, then a compromise debridement may have to be done in the emergency room A booster injection of 0 5 cc of tetanus toxoid or 3,000 to 6 000 units of tetanus antitoxin should be given to all patients with badly contaminated wounds and in this type of case, a broad spectrum antibiotic should also be given in the accident room

PREOPERATIVE PREPARATION

The patient must be carefully evaluated to identify coexisting pathological conditions before operation is performed The history of preexisting illnesses such as diabetes and cardiorenal disease should be determined and the blood pressure and pulse pattern immediately after admission to the hospital should be carefully evaluated

The dosage of preoperative medications in the injured elderly patients must be small Should shock exist intramuscular or subcutaneous injections may be of little value since absorption is markedly impaired in the presence of an inadequate peripheral circu

lation One must also remember that if the desired effect is not obtained by intramuscular or subcutaneous injections further sedatives especially those with respiratory depressive actions should not be administered If a patient has received multiple doses of narcotics and then has a return of normal blood pressure the injections in the subcutaneous or intramuscular areas act as a depot and all drugs at injection sites become effective simultaneously thus leading to overdosage of the medication Frequently the only required preanesthetic medication may be a small dose of atropine Usually 0 0002 to 0 0003 Gm will be sufficient preoperative medication for the elderly person who is to be subjected to general anesthesia Scopolamine has the undesirable property of producing hallucinations and disturbed sensorium in the preoperative aged patient Morphine is seldom administered because of its respiratory depressant effect Demerol 25 to 50 mg may be used if the patient is experiencing severe pain prior to the emergency surgery

Transport of the elderly injured patient from emergency to operating room and transfer from stretcher to operating table must be accomplished with gentle care The patient should be placed on a well padded operating table to prevent pressure areas on the sacrum or other bony prominences since only an hour or more of pressure may initiate a decubitus which will last for many months The prevention of pressure on peripheral nerves is also to be considered Pressure of straps and bandages over the neck of the fibula may cause common peroneal palsy with resultant foot drop Pressure of the arm over the edge of the table or over an arm board may cause peripheral nerve injury to the upper arm

POSTOPERATIVE CARE

The care of the patient in the recovery room is particularly significant in this group of patients Hypotension is the most frequent and most troublesome problem which is encountered in the immediate postoperative period The differential diagnosis is difficult in many instances Postanesthetic hypotension has been discussed in an earlier chapter and is usually associated with a warm dry skin and a slow pulse Hypovolemia is the most frequent cause of hypotension in the postoperative period in these patients however caution must be exercised in the transfusion therapy of patients who require multiple units of whole blood Overtransfusion and hence artificial polycythemia becomes a danger which may lead to circulatory failure and cerebral myocardial and peripheral thrombosis Analgesics should be administered in minimal dosages to prevent depression of circulation and respiration Demerol 25 to 50 mg every 3 or 4 hours is sufficient until the patient has reached a stable status Patency of airway must be maintained throughout this period

The most important postoperative therapy is that which is directed against the specific complications seen in the elderly There are certain generalizations which it is necessary to point out The elderly patient does not stand immobilization in bed for long periods and early ambulation is most important in his recovery and rehabilitation For this reason a method of treatment should be used which will allow the patient to be taken from his bed and to become ambulatory within a few hours after the operation or the injury If the patient cannot be removed from the bed because of restraining casts or traction he should be turned as frequently as possible within the limits of his confining apparatus Use of the muscles of uninvolved portions of the body should be stressed and vigorous encouragement of full range of motion instituted early Many of these patients are subject to mental depression and every effort must be made to encourage them this will do much to relieve their depression Since it is often difficult for some to move about they may quickly and easily develop pressure sores unless constant supervision is maintained to prevent this Many elderly patients detest lying on their ab

domens and will continue to lie in one position on an ulcerating sacral decubitus unless they are forced to change position It is therefore necessary that the surgeon and the nurses cooperate in a vigilant insistence on frequent turning and thus prevent the patient from remaining in one position for a long period

TREATMENT OF COMPLICATIONS

Since the most important therapy in many of these injured patients is the treatment of a preexisting condition, the more common of these conditions will be discussed with relation to the traumatized individual

Cardiac Complications

The most serious cardiac complication which is encountered is cardiac decompensation Patients with decompensated hearts at this age are usually in a very delicately balanced condition and this change in their environment caused by injury is apt to increase their difficulties Any treatment which necessitates anesthesia operation, or the application of plaster or traction or any immobilizing apparatus which necessitates continuous bed treatment may end fatally It is therefore often necessary to compromise in the treatment of the acute condition and concentrate on the treatment of the cardiac condition until it can be stabilized to such an extent that treatment of the injury is possible

Both cardiac decompensation and a relatively recent myocardial infarction may preclude surgical intervention or aggressive treatment of coexisting injuries for a time It is frequently difficult to determine the previous care afforded the cardiac condition in the elderly person because of poor sensorium or poor memory at the time of admission and the family s lack of knowledge about the existence of previous medical diseases Accordingly it is necessary to determine by electrocardiography, by careful physical examination and by determinations of venous pressure whether or not the patient is actually in a state of fairly severe cardiac decompensation The rhythm and rate of the pulse are carefully noted and will lead to institution of corrective measures for abnormal rhythms or tachycardia due to cardiac decompensation Electrocardiography is employed routinely in the care of these patients and frequent medical consultation is obtained The care of the patient in failure will consist in attempting to arrive at an optimal state by digitalizing him rapidly with Cedilanid or by implementing the previous digitalis dosage by oral or intramuscular or intravenous digitoxin in suitable dosages varying from 0 1 to 1 mg

Diuretics are usually employed Diamox is frequently employed if the patient can take this by mouth Occasional mercurial diuretics are injected as necessary Careful observation of fluid intake and output are a very necessary part of the therapeutic regimen Venous pressures must be carefully determined and these will lead to a better understanding of the state of decompensation present in the patient The use of a low salt diet speaks for itself and should be employed with relative frequency in these elderly persons who will not tolerate storage of large dosages of sodium or chloride ions in the extracellular fluid space Orthopnea is a frequent problem and will often preclude the use of traction apparatus because the patient must remain in a relatively upright position In this case it is possible to apply some traction to the lower limbs by elevating the foot of the bed high enough so the orthopneic patient may retain elevation of the thorax The traction can be placed at the hip or femur through the previous elevation of the lower portion of the bed without removing the respiratory aid of the orthopneic position Electrocardiogram should be obtained on all elderly patients as previously mentioned and this will frequently be very important in directing the treatment The fact that most elderly persons have moderate changes in electrocardiograms should always be borne in mind Coronary artery disease is extremely common but of great impor

tance is the detection of a serious lesion of the conduction system such as a left bundle branch block or recent acute coronary occlusion Frequently a coronary or cerebrovascular accident may be the contributing cause of the patient s fall and subsequent injury It should be stressed however, that only with extremely advanced coronary lesions will the immediate emergency care of the injury be deferred for any appreciable length of time

Renal Complications

Because the elderly commonly suffer from renal diseases such as arteriolar nephrosclerosis due to hypertension or arteriosclerotic changes in the kidney, and because of the frequency of prostatic obstruction with resultant bilateral hydronephrosis, it is extremely important that the patient s urinary status be carefully studied in the preoperative and the posttrauma periods The status of the urinary tract can be fairly well determined by the use of urinalysis blood urea nitrogen and if necessary urea clearance studies If the urinalysis proves normal and the patient is able to concentrate above 1 015 to 1 017 specific gravity the chances are that the patient has adequate renal status to carry him through surgery Should the urinalysis prove that there are abnormal findings such as white blood cells red blood cells casts and albuminuria and a coexisting fixed specific gravity of 1 010 one must further evaluate the urinary system This is done by blood urea nitrogen and urea clearance studies Should there be an elevated blood urea nitrogen level it is frequently wise to attempt to hydrate the patient being careful that one does not overload the cardiovascular system If the patient is able to produce a large urinary output with hydration it is possible that the blood urea nitrogen level will return to normal and that the patient therefore will be a somewhat better operative risk If the patient is in advanced uremia the prognosis is not good The uremia will lead to a metabolic acidosis with a decreased level of carbon dioxide combining power frequently a decreased calcium level and increased phosphate level Because of this it will be extremely difficult to carry the patient through a prolonged period of general anesthesia In addition the altered metabolic status of the patient s vascular system will lead frequently to myocardial irritability and inability to withstand any period of hypoxia or administration of myocardial irritants during the anesthetic period

The prostate is so commonly enlarged in the older male patient that this constitutes a hazard in the treatment of trauma among the elderly Even though the patient may never have had a urinary retention or never have been conscious of the fact that he had a markedly enlarged prostate when injury occurs necessitating an operative procedure urinary retention may suddenly occur In many of these cases it is necessary to perform a prostatic resection before the patient can be rehabilitated

Cystitis and urinary infections are apt to follow trauma and its subsequent treatment and are sometimes the result of catheterization necessary in caring for acute injury Urinalysis combined with careful and if necessary repeated urine cultures plus adequate drainage of the lower urinary tract will lead to control of these infections Gantrisin in doses of 0 5 to 1 Gm four times a day is usually sufficient to control a mild cystitis or pyelonephritis If necessary broad spectrum antibiotics can be used Sensitivity studies in these infections which are not easily controlled are imperative then the suitable antibiotic can be selected from the sensitivity study

Vascular Complications

Most elderly patients have arteriosclerosis to some degree and sometimes in a serious enough form to interfere with treatment and convalescence Many patients who may have cerebral arteriosclerosis to such an extent that their mental state is distinctly abnormal will often be extremely difficult to care for particularly those who must be bedridden

Often the patient with mild cerebral arteriosclerosis may exhibit marked increase in the arteriosclerotic signs and symptoms after a minor accident or a minor operative procedure Occasionally these aberrations result in remissions, and the patient returns to almost normal status but usually the changes are permanent and even progress rapidly after the trauma These patients are difficult to ambulate, and many who need to use crutches cannot be taught to walk except by a walker or by supporting attendants In many cases it is therefore necessary to sacrifice the advantages of protective weight bearing by means of crutches and to allow the patient to ambulate with full weight bearing particularly in the postoperative treatment of intracapsular fractures in the neck of the femur It is sometimes necessary to allow weight bearing long before one would expect this to be a safe procedure

The peripheral circulation in many elderly patients is extremely poor and delicately balanced Any prolonged maintenance of a position on the operating table or use of constrictive bandages during the operative procedure may cause serious complications in the limb This is particularly true of the lower extremities where fractures may be complicated by the circulatory disturbances of the foot and leg The use of the tourniquet in the elderly is distinctly contraindicated during the operative procedures since the tourniquet may do lasting harm to the circulation The position of the limb in traction apparatus or in plaster must be carefully planned so as to allow the most efficient circulation In many instances it is necessary to elevate the limbs for proper traction, but this may sometimes be contraindicated as it will arrest peripheral arterial blood supply Traction to the extremities on the operating table particularly in the operation for fracture of the hip must be very carefully applied so as to cause no constriction of the circulation of the foot

The application of plaster to the arteriosclerotic limb needs particular attention since the circulation is apt to be deficient Circular plaster should never be applied in an acute injury to a lower extremity in an elderly person unless the person is confined to the hospital and observed It is wise to follow the general rule that all circular plaster must be split through to the last thread as advocated by Bohler

Lung Complications

Those patients who have had bronchiectasis and emphysema have poor resistance to the pulmonary complications which are apt to follow immobilization in plaster particularly after an anesthetic The type of anesthesia is extremely important in these cases, and on occasion local anesthesia is preferable if it is possible to perform the operation under these conditions Although spinal anesthesia is not recommended for the elderly it is sometimes preferable to an inhalation anesthesia in those patients with preexisting pulmonary disease

After any serious trauma and particularly after one necessitating an anesthetic elderly persons are very apt to develop pulmonary complications If there has been an injury to the ribs or to the chest wall pulmonary secretions sometimes in alarming amounts are inevitable For these patients it is sometimes necessary to perform a tracheostomy in the early stages of the treatment to prevent the collection of secretions in the tracheobroncial tree The care of the tracheostomy in the elderly should be even more meticulous than in the younger adult The reader is referred to the sections on Anesthesia and Postoperative Care

Gastrointestinal Complications

The most common gastrointestinal complication to which the injured elderly patient is susceptible is abdominal distention This complication occurs in patients with no previous history of intestinal disorder who having sustained a fracture or other trauma are confined to bed They very rapidly develop abdominal distention which at times becomes alarming and needs active treatment Once it occurs it is necessary that the lower

bowel be examined if fecal impaction is present it should be removed promptly The abdominal distention may not become apparent for several days after the patient is injured and may not become a problem for 3 or 4 days after he has been confined to bed It is therefore essential that the surgeon anticipate the possibility of this complication and attempt to use methods of treatment which will allow the patient to be moved about mobilized or ambulated

Should a serious paralytic ileus develop prostigmine or other similar drugs are helpful in initiating peristalsis Prostigmine in doses of 1 to 2 mg by injection or Urecholine in injections of 5 mg three times a day are helpful in initiating this peristalsis Magnesia glycerin and water enemas or other mildly irritating enemas may help passage of gas by rectum if mild peristaltic sounds are present It should be remembered that if abdominal distention becomes severe and is true paralytic ileus nasogastric suction and administration of necessary intravenous fluids must be carried out If the patient s paralytic ileus becomes too severe it may well lead to elevation of the diaphragms and decrease in already restricted pulmonary ventilatory capacity

Gastric dilatation is also a complication which frequently follows injury in the aged and the use of the Levin tube as a prophylactic measure in all abdominal injuries is most important By this means gastric dilatation may be prevented and intestinal distention minimized Any other procedure which involves the thorax or abdomen must necessarily include the use of the Levin tube in the postoperative treatment Early ambulation is a helpful adjunct to the treatment

Acute Cholecystitis

Acute infection of the gallbladder is one of the common complications found in elderly persons who are confined to bed for any reason particularly those who are injured and must remain in bed The symptoms of pain nausea and vomiting and signs of abdominal tenderness associated with hyperpraxia may be overlooked if other symptoms caused by the trauma are more obvious The surgeon must keep the diagnosis of acute cholecystitis in mind whenever these symptoms arise and must make sure that the physical signs are not masked by morphine sedatives and that the abdomen is not inaccessible because of the presence of a plaster spica If signs of acute cholecystitis appear operation should not be delayed unless the concomitant injuries are so serious as to preclude anesthesia and operation The choice of operation is cholecystectomy but if the patient is too ill to withstand the operation or if the technical difficulties preclude easy removal of the gallbladder then a cholecystostomy with removal of stones and drainage of the gallbladder is preferable to the more extensive operation The gallbladder can then be removed at a later date when the patient has recovered from his injury

Paget s Disease

Patients who suffer from Paget s disease are often subject to fractures in the region of the diseased bone Particular care is required since the fracture is apt to heal slowly with the development of a callus which does not withstand weight bearing well In the presence of Paget s disease internal fixation is often difficult to apply because of the softness of the bone and plates are apt to be inefficient because the screws do not hold well in the diseased bone The intramedullary rods in the femur may be difficult to insert because of the deformity of the intramedullary canal and because the cortex of the bone can easily be penetrated by the rods In many cases multiple fractures occur when the rod is driven through the intramedullary canal (Fig 29 3) However this does not interfere with healing since the fractures caused by the rod are usually healed without difficulty The original fracture however may take a long period to heal and particularly in the case of the femur it will not be possible to remove the rod until solid healing is obtained

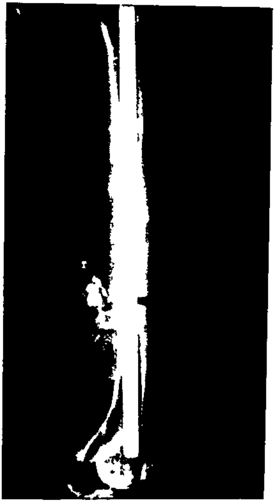


Fig 29 3 Fracture of the femoral shaft in Paget s disease treated by intramedullary nail Note several transverse fractures caused by the nail

Pathologic Fractures

Other pathologic fractures occur at the site of involvement of the bone by metastatic carcinoma from breast adrenal tumor, prostate, etc The most common sites for metas tases resulting in fractures are in the upper third of the femur and in the humerus These areas are most apt to be involved by meta static foci of carcinoma and since these areas are subject to severe strains and leverages, they will easily fracture Pathologic fracture is one of the primary indications for intramedullary rods in treating injuries of bones The patient with the pathologic fracture may have only a few months to live but if he is confined to bed in traction or plaster or otherwise immobilized during the remaining period of his life he will only present a more serious problem in nursing care When the intramedullary rod is inserted in the femur or the humerus the patient can be mobilized he can use the limb and the severe pain which results from these fractures is imme diately relieved If the rod in the intramedul lary canal goes through an area of metastatic carcinoma it may possibly cause a spread of the disease in the medulla of the bone There are, however, no reports to indicate that this is so It is quite true that if the fracture site must be opened for reduction of the fracture and insertion of the nail the tumor will often develop more rapidly in the soft parts about the fracture site and into the operative wound It is also common for the area involved by the tumor to bleed profusely at operation particularly in the case of renal tumors This must be antici pated and preparation made for control of hemorrhage if the hemorrhage is severe, amputation may have to be considered

When a patient has a metastatic lesion in the usual sites in the femur or in the humerus and fracture seems inevitable prophylactic intramedullary rod fixation will prevent frac ture and will often allow the patient months of comfort without the pain and disability resulting from the fracture which would most surely occur later In these cases it is not necessary to expose the fracture site The nail can be driven through the greater trochanter in the case of the femur (Fig 29 4*A*) and through the upper end of the humerus in the case of that bone and can be done blindly This eliminates one of the disadvantages of the operative proce dure on the fractured bone i e hemorrhage from the fracture site and spread of the dis ease in the wound of exposure In some in stances insertion of the rod as a prophylactic measure in metastasis from breast cancer has been followed by a calcification in the area of the previously involved bone (Fig 29 4*B*)

Parkinson s Disease

Since a considerable number of elderly persons suffering from Parkinson s disease



Fig 29 4 *A* Left metastatic lesion of upper femoral shaft in which fracture is inevitable Right after prophylactic nailing with Rush nail *B* Anterior posterior and lateral views of same bone 6 months later showing filling in of defect

sustain trauma resulting in fractures the complicating preexisting disease changes the treatment in many instances These patients are often bedridden or confined to a chair or do not ambulate well and for this reason they may have sustained the fracture As a result of the fracture and the necessary treatment the Parkinson s disease becomes aggravated and the patient may become a more difficult nursing problem Strangely enough a patient with Parkinson s disease can withstand considerable trauma and operative treatment and survive so that these patients often are serious problems for many months after their initial accident Therefore in the case of the intracapsular fracture of the neck of the femur it has now become the authors policy to use a primary femoral head prosthesis as the treatment rather than to attempt to use the Smith Petersen nail alone The nail is very apt to be displaced from the bone and extruded thus necessitating a secondary reconstruction operation The authors believe that in a severe case the primary femoral head replacement is a procedure of choice In other fractures and trauma to other organs the parkinsonian case presents many problems because of speech defects difficulties with bladder and rectum and the great difficulty in achieving full ambulation

Peripheral Nerves

The elderly patient is likely to be undernourished and thin and the bony prominences over which peripheral nerves course are apt to cause pressure on the nerves as a result of the application of fracture apparatus plaster or bandages or merely of the long continued immobilization in one position in bed The most common peripheral nerve involvement is the injury to the peroneal nerve as it courses over the neck of the fibula Patients in Russell traction are particularly likely to have pressure in this region due to the external rotation of the

limb against the traction sling It is necessary for the pressure to be operative for only a few hours to cause a paralysis which may last for many months Whenever an elderly patient is placed in Russell traction the limb must be maintained in internal rotation by means of flexion of the hip and knee to almost 80° and the area over the neck of the fibula must be protected The internal rotation may be further assured by means of an Ace bandage wrapped around the leg below the junction of the upper and middle third and continued to a rope over a pulley at the top of the traction apparatus so that a pound or two of pull on the bandage will help to rotate the limb internally

Pressure of the outstretched arm on the operating table or the armboard for application of blood pressure cuff or the administration of intravenous fluids is apt to cause an injury to the radial nerve as it crosses the junction of the lower and middle third of the humerus It is wise to have all these areas well protected during an operative procedure When the arm is suspended over the head to remove it from the operative field during an operation on the hip pressure on the radial nerve may result from either traction or bandaging

Aneurysms

Unsuspected aortic aneurysms may exist in patients who are subject to trauma and rupture may occur Aneurysms of the popliteal region also are likely to rupture as a result of a minor accident but the marked swelling pain and disturbance to the distal portion of the limb should make prompt diagnosis possible so that early operation, resection and grafting of the area can be performed

Skin Complications

One of the most troublesome of complications stems from circulatory disturbances which cause skin infection or ulceration Great care must be taken to prevent pressure on all bony prominences and to prevent injury to the skin when adhesive or other forms of traction are used Patients who are subject to chronic skin disease such as psoriasis or eczema must be carefully evaluated before the area involved is operated upon or any skin traction applied It is unwise to insert skeletal traction through areas of preexisting skin infection Because of the poor circulation in the lower extremity in many of these patients ulcerations may quickly develop from a minor trauma or from the trauma of the traction or plaster Elderly patients develop skin blebs at sites of injury exactly as do younger individuals The resulting skin injury may cause dangerous ulcerating areas which preclude necessary operations

Senile Osteoporosis

The marked loss of calcium so often seen in the elderly particularly in the female is one of the predisposing factors in many fractures and it is necessary to make every effort to prevent further decalcification as the result of immobilization necessary to the treatment of the fracture Disuse atrophy progresses rapidly in the senile bone and the most important single therapeutic measure is early continuous and active mobilization The surgeon should make every effort to use a method of treatment which will allow mobilization and the patient must be encouraged to make use of every opportunity to exercise his muscles move his joints, and walk if possible

Since senile osteoporosis is seen much more frequently in women at or past the menopausal age a deficiency of gonadal hormone is suspected as an important factor in this condition For this reason estrogens usually Premarin are administered orally in very large dosage up to 10 mg daily in three divided doses Unless the patient has had a hysterectomy it is important to carry out Premarin therapy for 20 days and discontinue for 10 days to allow suitable withdrawal effect of the drug to prevent uterine bleeding

A high calcium and high protein diet is

necessary and must be strictly followed In addition the intake of calcium is increased by the oral administration of calcium lactate in doses of 2 Gm four times daily

TREATMENT OF SPECIFIC INJURIES

Head Injuries

In today s civilian injuries the automobile as mentioned earlier is a prime cause of injury In these accidents over 75 per cent of injured suffer some injury to the head While many are minor injuries 4 per cent prove fatal and over 10 per cent require skilled neurosurgical observation and treatment In the elderly the thinned hair in the male the thinned calvarium and fragile cerebral vessels all predispose to head injury following minor episodes of trauma Superimposed upon these injuries are frequent preexisting mental aberration or at least slowed cerebral function which hinders any attempt at definite diagnosis of cerebral injury following trauma Amnesia or other defects of cerebral function of minor or severe degree may antedate the accident and make the diagnosis difficult Therefore subtle symptoms and signs of serious intracranial lesions may be overlooked or attributed to the age and senility of the patient in question

In those elderly patients sustaining head injury the problems are magnified because of the inherent vascular problems of the aged The coma or semicoma accompanying even a cerebral concussion may lead to a relatively slight degree of anoxia Even this small decrease in oxygen supply to the brain heart or kidneys may prove a deciding factor in the eventual recovery of the patient

In extradural hemorrhage usually caused by tear of the middle meningeal artery unconsciousness or marked obtunding may rapidly become manifest Such a state in the elderly is poorly tolerated Hence extremely aggressive therapeutic measures must be undertaken to relieve intracranial bleeding (rapid diagnosis trephining etc)

On the other hand subdural hematomas may be very subtle in many ways The cause of injury may be very minimal and even go unnoticed The early central signs caused by small subdural collections of blood may be overlooked in the old or senile patient Frequently only after several days or weeks will the subdural hematoma cause more obvious signs of fluid absorption and expansion of its confines in the subdural space The neurologic signs may be difficult to interpret even after a long period following injury Therefore any elderly person who exhibits unusual behavior be it only minor aberrations should be carefully observed and if necessary subjected to bilateral burr holes to rule out the presence of a subdural hematoma

More obvious large collections of blood in the subdural space should be evacuated as soon as diagnosed as coma or stupor is poorly tolerated by the fragile geriatric patient

One should remember that cerebrovascular accidents are quite common in this age group It is possible that an overlooked mild cerebral thrombosis may well have precipitated an accident and that the accident itself had not actually produced any head injury The differential diagnosis between those central nervous system lesions existing prior to accident and those caused by accident can be extremely difficult and often exploratory burr holes must be performed to establish a working diagnosis

Chest Injuries

Vital capacity and tidal exchange are greatly reduced in most elderly patients When these patients suffer chest injury with or without other body area injury many alterations in pulmonary physiology may occur any of which may prove a serious problem to a person with little pulmonary reserve

The most frequent injury is fracture of one or more ribs by direct trauma In most elderly patients some degree of emphysema has led to decreased pulmonary reserve

When rib fracture causes voluntary splinting of one or both hemithoraces, anoxia frequently occurs Such anoxia can tip the balance for survival against the patient It is here that treatment must be vigorous and directed toward return of maximum ventilation Adhesive strapping is usually contraindicated, because the pulmonary expansion is so restricted by tape that atelectasis and bronchopneumonia are prone to occur Intermittent sandbagging or wearing of a snugly fitting vest will afford enough relief to the patient to make him cough and therefore clear his tracheobronchial tree Should these simple measures prove inefficient, procaine block of all affected intercostal nerves may be performed Often the immediate relief of pain will lead to gratifying increase in pulmonary gaseous exchange and marked improvement in the patient s condition

If a minor rib fracture is not cared for in a vigorous manner the vicious syndrome of wet lung may develop Here local pulmonary parenchymal trauma leads to localized pulmonary edema, this edema leads to anoxia, and this anoxia leads to a spread of the area of edema Such a vicious cycle is extremely difficult to interrupt in the elderly patient s chest Therefore it is best treated by prevention Should wet lung develop positive pressure oxygen and stabilization of any unstable portions of the chest wall combined with tracheostomy is the treatment of choice

Tracheostomy may well prove a lifesaving procedure should secretions collect in the larger branches of the tracheobronchial tree or should paradoxical respiration occur owing to large chest wall injury A recent aphorism states if a tracheostomy is considered it should be performed

Any intrapleural collection of air or blood must be completely evacuated rapidly in order to maintain adequate exchange of air

If the surgeon remembers that anoxia in the aged is a condition which cannot be tolerated and if he directs his efforts towards adequate supply of oxygen to the injured patient, the many well established principles of treatment of pulmonary and thoracic injuries will lead to adequate care in the injured old person

Abdominal Injuries

Blunt or penetrating injuries of the abdomen are most difficult to diagnose and treat in the aged person All too often his sensorium is clouded, and subtle abdominal findings cannot be elicited by the observer

Intraabdominal rupture of solid or hollow viscera must be cared for promptly, as here again delay will lead to loss of the elderly and debilitated patient who has little ability to withstand severe stress such as hemorrhagic shock or peritonitis

Analgesics must be used sparingly or not at all until fairly definite evidence exists to rule out serious intraperitoneal injury A very minimal dose of morphine may cloud the findings from abdominal examination anywhere from 4 to 6 hours

In recent years abdominal paracentesis with a relatively blunt needle has been helpful in establishing indications for abdominal exploration

As in any type of injury in the elderly, anesthesia may complicate the injury or the method of treating the injury Evacuation of recently ingested food by induced vomiting and not by gastric lavage by tube (a useless procedure) may be used in the patient who has recently eaten A corollary to this treatment is the use of crash intubation, where the patient is rapidly anesthetized with a relatively large dose of intravenous Pentothal (which causes total apnea and relaxation) An endotracheal tube is introduced before emesis can occur

All efforts must be directed to early correction of any acute intraabdominal disease caused by the recent trauma The general principles of abdominal surgery are, of course adhered to rigidly but an extremely conservative approach must be adopted In the elderly for example, diversion of the fecal stream must be carried out if any question exists concerning intraperitoneal closure of a perforated portion of the colon The

procedure of choice is that which will do most to ensure survival of the patient under emergency conditions At a later date after adequate preparation definitive reparative procedures may be accomplished at the relative leisure of the surgeon and patient

Genitourinary Injuries

In this field of endeavor diagnosis and the uses of diagnostic procedures reach a zenith of accomplishment By the use of intravenous pyelography cystography and urethrography adequate estimation of urinary tract injuries can be ascertained Lower urinary tract injuries are of course quite frequent with pelvic fractures because of the proximity of the urinary bladder to the rami of the pubix and ischium

Diagnostic procedures should be aimed at early restitution of lower urinary tract disruption Upper urinary tract lesions such as renal lacerations or contusions can be handled more conservatively Here watchful waiting is acceptable with the necessity of renal exploration held in reserve for that patient who either loses or fails to gain ground over a reasonable time in the post trauma period

All too frequently more pressing abdominal or thoracic injuries preclude immediate surgical care of urinary tract injuries In these cases the difficult priority of system care must be determined at the outset In such cases barring severe renal injury (i e massive rupture of the kidney or renal pedicle) the abdominal and thoracic injuries are attacked primarily and after suitable observation the renal situation is approached when the condition of the patient warrants

FRACTURES

The most common injury to which the elderly person is subject is fracture and it usually is the result of a minor trauma causing a break in the fragile bony cortex The most common fractures will be discussed in some detail

Fracture of the Hip

The most common fracture in the elderly is the fracture of the hip This fracture is sustained more commonly among women than among men and is usually the result of a slip on a rug or a missed step Therefore these patients do not usually have associated shock or multiple injuries and one may proceed to the treatment of the fracture in question limited only by the preexisting pathologic conditions from which the patient may be suffering

The elderly patient usually gives a history of having had a minor fall followed by severe pain of the hip and inability to stand or to use the involved extremity He lies in a characteristic position with the injured limb externally rotated and if there is upper displacement of the shaft as is most common there is obvious shortening of the limb

The patient must be transported to the hospital by ambulance and the limb is best immobilized by means of a Thomas splint (Fig 29 1*A*) This must be carefully applied so as to cause no further damage to the injured femoral neck and the degree of traction on the ankle must be carefully adjusted so that it does not constrict the circulation to the foot It is not necessary to apply more than gentle traction to the foot If a Thomas splint is not available the patient may be transported wrapped in blankets flat on a stretcher with as little motion of the affected limb as possible As a matter of fact it is sometimes preferable to transport the patient on a stretcher without any attempt to apply the Thomas splint since if it is applied in a clumsy manner the fracture site may be further damaged

Classification of Fractures of the Hip

Fractures of the hip are classified anatomically as (1) intracapsular including those fractures immediately subjacent to the head or to the narrow portion of the neck or (2) intertrochanteric indicating those fractures outside the capsule which involve one or both trochanters The anatomic classification not only is important in deter



A B

Fig 29 5 *A* Intracapsular fracture of femoral neck displaced in varus *B* After reduction on fracture table Pennies over middle of Poupart s ligament and over anterior surface of thigh 2 in below These serve as landmarks for *insertion of guide wire*

mining the position of the fracture site but also has a great deal to do with the decision as to the method of treatment and with the *prognosis*

Intracapsular Fracture This fracture through the narrow part of the neck at its middle or in the subcapital region is entirely within the capsule of the joint (Fig 29 5*A*) The blood supply in this region is deficient, since it is derived almost entirely from the vessels in the ligamentum teres and there are no attached muscles or ligaments to provide blood supply *The displaced intracapsular* fracture is also sometimes difficult to reduce since it is difficult to control the position of the small proximal fragment The prognosis in these instances is poor since nonunion is frequent and avascular necrosis of the head occurs in about twenty-five per cent of the cases

IMPACTED INTRACAPSULAR FRACTURES IN THE VALGUS POSITION There is one exception to the poor prognosis of the intracapsular fractures and that is the impacted fracture of the femoral neck in the valgus position (Fig 29-11*A*) In this so called *abduction type* of fracture the *femoral neck is* impacted into the cortex of the head in such a manner as to fix the fragments together so that the patient can often rotate his limb, raise it from the floor and in many instances even walk, although usually with pain It is important to recognize these fractures, since if they are missed and remain untreated the patient may continue to walk about with *only a complaint of pain in the hip* After a period of 3 or 4 weeks however when the absorption which usually occurs at the fracture site develops he may then fall to the ground the fractured fragments having separated The patient may now have a displaced fracture with varus deformity a con*dition with a very poor prognosis* Patients suspected of sustaining injury to the hip should be examined by x ray and the x ray films carefully evaluated by an expert in every instance to prevent this tragic happening

Intertrochanteric Fracture In this classifi*cation the fracture involves the region* between the greater and lesser trochanter, where the blood supply is abundant and where attached muscles and ligaments add nourishment to the area in cancellous bone (Fig 29-12*A*) Union progresses *invariably* and nonunion is rare The callus may be *soft however* and will not stand weight bearing for a long period The prognosis for healing is therefore always good but protection of the injured area is necessary

Treatment of Fractures of the Hip

Intracapsular Fracture The displaced intracapsular fracture of the neck of the femur should be treated by means of internal fixation No conservative treatment of traction or reduction and immobilization in plaster is acceptable Even with the best methods of internal fixation union can be expected in only about 50 to 60 per cent of the cases and in 25 per cent of the cases that do unite one may expect late complications resulting from avascular necrosis This complication may not develop for many years and in fact may not be disabling but in some instances it may be so disabling as to make reconstruction operation necessary

OPTIMUM TIME OF OPERATION The fracture of the neck of the femur should be operated upon and internal fixation performed as soon as possible after the accident occurs and the patient has been properly evaluated It is unwise to take the patient directly to the operating room from the accident room and it is equally unwise to wait several days until the operating room becomes available If the operation is done as an immediate emergency complications such as diabetes and coronary disease may be overlooked Therefore it is necessary that the patient be carefully examined that the status of his heart lungs and kidneys be estimated and that any preexisting complicating pathologic conditions be corrected as soon as possible before the operation is performed It is important that the proper choice of anesthesia be made and that the preoperative sedation or narcotics be carefully administered General anesthesia induced by Pentothal Sodium and continued by inhalation anesthesia is the most satisfactory type in the aged (see Chap 4) After the patient has been properly hydrated and the blood typed and cross matched at least 500 cc of whole blood of proper type should be on hand for the operation

OPERATION The patient is placed on a good fracture table in the supine position with the perineum against the perineal bar It is most important that this area be properly padded and equally important to see to it that the sacral rest be well padded and be kept dry before the operation is begun It may be necessary to start the anesthesia before the patient is transferred from his bed to the operating table If possible the transfer is made before the anesthesia is begun but causing the patient a minimum of pain While the injured limb is carefully supported the sound limb is attached to the foot piece on the traction bar of the table This should be done with the foot dorsally flexed to a right angle so that it will not slip out of the confining bandages It is only necessary to apply two strips of bandage to the foot to ensure that it be held in position The foot is then visible at all times so that circulation can be evaluated and there is little danger of the foot slipping off the traction plate A moderate amount of traction is applied and the foot is elevated to allow the positioning of a portable x ray machine under the leg so that the lateral x ray films of the injured hip can be taken A mild traction is then all that is necessary to hold the patient against the perineal bar

If the fracture is displaced the operator then proceeds to reduce the fracture by exerting traction in the long axis of the femur The traction need not be excessive and in most instances a gentle pull may be enough to reduce the overriding of the fragments The external rotation is then corrected by internal rotation and the leg is abducted to about 30 It is not necessary to abduct the leg fully X ray films are then taken with metallic markers over the middle of Poupart s ligament and over the shaft of the femur at a distance of 2 in below the greater trochanter (Fig 29 5*B*) These markers serve as landmarks on the first x ray film for insertion of the guide wire and their position on the skin is marked by means of a dye such as gentian violet so that when the skin is prepared the marking remains

If the reduction is satisfactory the operation may then proceed If however the reduction is not satisfactory the manipulation

should be repeated If a second reduction is not successful, it may then be necessary *to open the hip joint, visualize the fracture* site and reduce the fracture by instrumental manipulations If *reduction is satisfactory* the injured limb is fixed to the traction apparatus exactly as is the sound limb care being taken to maintain internal rotation so that the patella is pointing inward about 5° This position is sometimes hard to maintain unless the foot is well fixed in the traction apparatus If not accurately fixed it will invariably slip, thus changing the position of the femoral neck and interfere with the good placing of the guide wire

When the patient is in position the skin of the area of the upper thigh perineum, *and hip region is cleansed and prepared with* triple applications of Zephiran The area is then draped with towels and sheets, these being affixed to the skin by means of silk sutures Towel clips should be avoided since these instruments interfere with proper x ray examination and are not as satisfactory in holding the drapes in place

An incision is then made from a point 1 in *below the greater trochanter* downward for at least 5 in It is not wise to attempt to operate *through a small incision since the* small wound does not heal any more quickly than a larger wound and adequate exposure is necessary for the proper placement of the nail The fascia lata is divided and a towel is then sewn to the posterior skin edge by means of a continuous silk suture The anterior towel is not sutured in *place until* after the placement of the guide wires since *it is necessary to keep in full view the* markers on the skin which correspond to the metallic objects on the first x ray film The wound is deepened through the vastus muscle at one area and then deepened to the femur Bennett tibial retractors are then inserted into the small opening in the vastus muscle and placed on each side of the femur Traction on these retractors then stretches the *muscle and it is easy to* enlarge the wound in the muscle in the line of its fibers The branches of the lateral circumflex femoral artery can then be easily visualized, clamped, and ligated The shaft of the femur is exposed and a point chosen on it about 2 in below the tip of the greater trochanter This *point is chosen* with reference to the guide marks on the original x ray film Ideally, *the guide wire should be inserted through* the cortex so that when it is driven along the course of the *inferior cortex of the neck* it will insert into the center of the femoral head or just inferior to the center (Fig *29 6A*) It should never be inserted so that it enters the head superiorly, since the nail may cut out in this region

A large hole is drilled in the direction in which the guide wire is to be placed The drill hole is larger than the guide wire so *that when the latter is inserted the operator* can feel his way in the intramedullary canal and feel the *guide wire* enter the femoral head thus avoiding penetration of the cortex It is wise to use a guide wire that is not notched since the wire is easily broken at a notch when the nail is driven over it After the wire is driven into the head an estimated correct distance x ray films are taken if the *position is correct the operation may* proceed If however the guide wire is not per*fectly placed a second hole in* the cortex should be made and a second wire inserted leaving the first wire in place as a guide It is unwise to attempt to remove the original guide wire and replace it from memory When anterior posterior and lateral x ray films show that the guide wire is in position *the cortex is prepared for the Smith* Petersen nail One may use a small osteotome to *prepare openings* in the cortex to receive the flanges of the nail Some surgeons prefer a reamer or bore to cut a hole in the cortex of sufficient size to allow insertion of the nail without splitting the cortex While the nail is being driven over *the wire pressure* against the superior flange of the nail will *help to prevent splitting of the cortex* When the nail is felt to have penetrated the cortex properly it may be driven further into the head, x ray films taken and the position checked Proper measurement of the guide

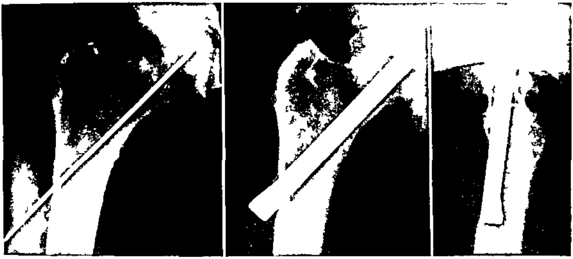


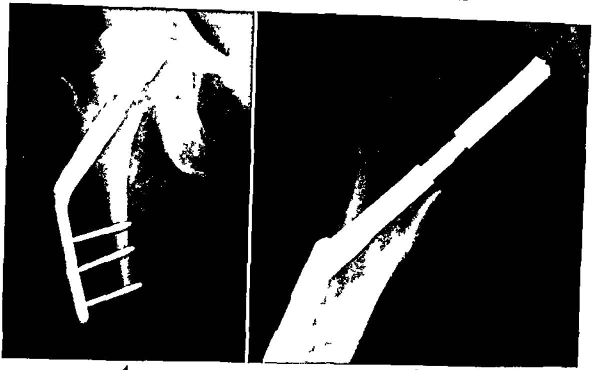
Fig 29 6 *A* Guide wire in position Note that it enters low on the cortex traverses the neck near its inferior border and enters the head just inferior to its center *B* Placement of Smith Petersen nail anterior posterior view *C* Lateral view showing position in the center of the head

wire for insertion of the nail will usually avoid the necessity of removing a nail and reinserting it Reinsertion of the nail causes enlargement of the hole in the cortex and prevents proper gripping of the nail The nail is driven into the head so that it is within ¼ in of the articular cartilage (Fig 29 6*B* 29 6*C*)

The traditional Smith Petersen nail operation is completed at this point but because of the fact that in many instances the nail may later be extruded thus causing failure of the operation various modifications of this method have been used A plate may be applied to the shaft holding the nail in place or a Jewett nail (Fig 29 12*B*) or collapsible nail such as the Pugh (Fig 29 7*A*) or Massie (Fig 29 7*B*) may be used In The New York Hospital clinic the authors have recently modified this method by applying a small two-hole or three hole plate to the shaft of the femur after insertion of the usual Smith Petersen nail The upper end of the plate is bent away from the nail so that there is an interval of about ¼ in from the nail to the plate The plate is not attached to the nail (Fig 29 8*A*) If the nail tends to extrude because of absorption of the neck it is prevented from extruding farther by the back out plate (Fig 29 8*B*) The wound is then closed in layers with use of silk or catgut for the fascia and muscle and silk or stainless steel wire for the skin

Postoperative Care After the patient has recovered from the anesthesia he is returned to his bed as soon as possible he is sat up and moved about in the bed Great care is taken that he does not lie in one position and that he does not retain pulmonary secretions Within a few hours or when he has recovered from the anesthesia he is moved out of bed and into a chair He is taken out of bed two or three times daily thereafter is encouraged to move about while in bed and as soon as possible is allowed to walk in a walker or with crutches In some instances where there is some distraction of the fragments the patient is allowed to bear some weight on the leg for a few days to ensure impaction No effort is made to impact the fragments at the operating table and if impaction is necessary the weight bearing immediately after the operation impacts the fragments satisfactorily

The patient is encouraged to walk with crutches and is taught to place his injured foot on the ground but is allowed to bear



A B

Fig 29 7 Collapsible nails to allow for absorption of neck and settling of head *A* Pugh nail *B* Massie nail



A B

Fig 29 8 *A* Application of back out plate to shaft of femur Its upper end is bent away from the end of the nail ¼ in so as to allow extrusion of nail *B* One month later after shortening of neck and settling of head nail is now impinging against back out plate

only a little weight He then goes through the motions of walking not attempting the more difficult walking with crutches which does not allow the foot to touch the ground An elderly patient is not able to walk well with crutches in the conventional manner and even if he should bear some weight on the affected leg it is usually not harmful

X ray films are taken at regular intervals following the operation and if position of the nail and the fragments remains good throughout the patient is allowed full weight bearing at the end of 4 months when union seems sound

If during the convalescent period the nail is extruded from the fracture site so that it does not hold the fracture efficiently if there is marked absorption of the neck with displacement of the head or if the absorption is developed to such an extent that nonunion is inevitable reconstruction operation is then immediately performed It is not wise to wait until there has been a considerable displacement of the shaft of the femur with contraction of the structures about the hip joint since this makes the operation more difficult

FEMORAL HEAD REPLACEMENT In an occasional case of the elderly patient who can not be expected to use crutches or who has Parkinson s disease or other complications which make the insertion of the nail unwise and in all cases of obvious or inevitable non union the reconstruction operation of femoral head prosthetic replacement is performed

In The New York Hospital–Special Surgery Fracture Service the Austin Moore prosthesis (Fig 29 9) is usually employed and is inserted through a posterior lateral incision

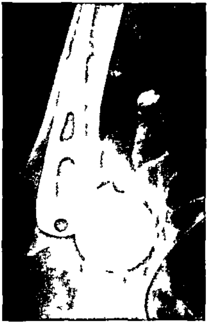


Fig 29 9 Austin Moore Vitallium prosthesis for nonunion of femoral neck fracture

The authors prefer exposure of the capsule posteriorly with posterior displacement of the femoral neck since postoperatively the external rotation of the limb is not so liable to cause dislocation as if the anterior approach is used The femoral head is removed and the neck prepared for reception of the prosthesis by means of a reamer Great care should be taken that the reamer does not extrude through the hole through which a Smith Petersen nail has been removed since this may cause fracture of the greater trochanter The prosthesis must be placed in such a way that there is some anterior inclination of the new femoral head

In reducing the prosthesis into the acetabulum after its insertion into the shaft great care must be taken not to put undue leverage on the fragile shaft of the femur since this may be fractured in the maneuver If such a complication does occur a long stem prosthesis is helpful in stabilizing the shaft of the femur as well as in providing a femoral head prosthesis (Fig 29 10)

TREATMENT OF IMPACTED INTRACAPSULAR FRACTURES IN VALGUS The impacted intracapsular fractures in valgus position (Fig 29 11*A*) has a very good prognosis and healing may be expected in every case provided that the fragments are not disimpacted and that the patient is not allowed to bear weight on the affected limb until it is healed

In the authors clinic these fractures are operated upon and internal fixation achieved by means of four Moore nails or by means



A B C

Fig 29 10 *A* Fracture of femoral shaft sustained at time of insertion of prosthesis in patient aged 86 nonunion at 8 months *B* Long stem Vitallium prosthesis designed for this case *C* Prosthesis in place allowing mobilization and weight bearing Note extreme decalcification of femoral shaft

of the Smith Petersen nail (Fig 29-11*B*) The four Moore nails have an advantage in that their insertion requires less force, hence there is less danger of disimpacting the im pacted head

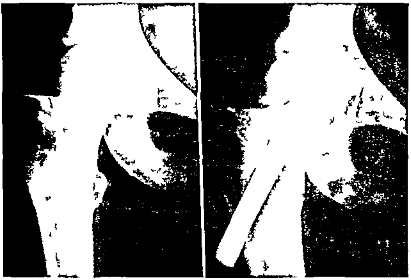
After insertion of the Smith Petersen or the Moore nails these patients are immedi ately allowed to walk with crutches with partial weight bearing and after a period of 4 or 5 weeks are allowed full weight bear- ing

Avascular necrosis results in about 25 per cent of these cases but there is no evidence to indicate that early weight bearing has any effect on its incidence If this complication does occur it may not become apparent for several years after the fracture and it may develop so slowly as to cause only mild symptoms of osteoarthritis In some in stances however, the head of the bone dis integrates completely and it is necessary to perform a metallic prosthetic replacement

Intertrochanteric Fracture The intertro chanteric fracture involves that portion of the bone between the greater and lesser trochanter Because of the abundant blood supply in this area and the fact that the bone is cancellous these fractures invariably unite However, they need long periods of im mobilization the callus is often soft and varus deformity develops unless the head and neck are supported

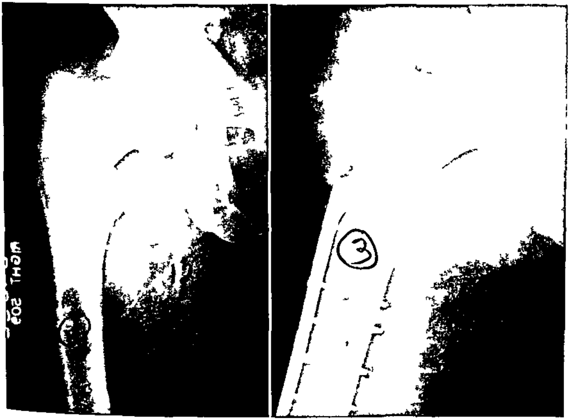
This fracture may be treated by means of Russell traction, skeletal traction or even reduction and immobilization in plaster The reduction and immobilization in plaster methods however have a higher mortality than operative methods There are cases however in which the fragments are so com minuted as to make internal fixation inade quate These cases are then treated by means of either Russell traction or skeletal traction with a wire through the tibial tubercle or through the lower end of the femur The authors do not use plaster immobilization for these fractures

In the stable type of intertrochanteric frac ture (Fig 29-12*A*), internal fixation is achieved by means of a nail and plate as the method of choice The authors prefer



A B

Fig 29 11 *A* Impacted (abduction) fracture in valgus femoral neck *B* Immobilized by insertion of Smith Petersen nail



A B

Fig 29 12 *A* Intertrochanteric fracture of femoral neck *B* Fracture immobilized by means of Jewett nail

the Jewett nail (Fig 29-12*B*) because of its strength at the junction of the nail and the plate

The patient is prepared exactly as described for the intracapsular fracture, and reduction is accomplished by traction in the long axis of the leg and internal rotation On occasion, internal rotation will separate the fragments so that some degree of external rotation may be necessary It is rarely necessary to use force in reduction of the inter trochanteric fracture

The nail is inserted as described above and depending upon the site and position of the fracture a Jewett nail with a four- five or six hole plate is chosen In choosing the Jewett nail, one must be sure that the angle of the nail is proper by careful measurement of the guide wire in the x ray film so that after insertion of the nail the plate will lie against the shaft of the femur

Postoperatively the patient is moved out of bed as soon as possible and early ambulation on crutches is encouraged Weight bearing is not allowed for at least 8 weeks in most instances although in very thin, fragile women who cannot use crutches the authors sometimes allow weight bearing as early as 3 weeks, provided the fixation is adequate and the fracture is a stable type

Fracture of the Wrist

The Colles fracture is the second most common fracture sustained in older individuals Because of its fragility the bone is often impacted with comminution and marked displacement of the fragments

The fragments may be difficult to reduce, and when reduced immobilization may be difficult to maintain because of the marked fragility of the bone and the tendency for the comminuted posterior cortex to absorb and allow a recurrence of the original displacement even after a perfect primary reduction

Although it is important to attempt reduction and to maintain the reduction by immobilization the most important objective for the surgeon to keep in mind at all times is the eventual function of the hand Since many elderly persons are afflicted with arthritis the joints of the fingers may be stiffened and may be susceptible to injury and immobilization It is therefore essential that mobilization of the joints of the fingers be protected even at the cost of position of the fragments and eventual deformity

The Colles fracture is a fracture of the lower end of the radius in which there may be only a fracture line through the radius without displacement The injury is sustained when the patient falls on the extended hand and if the force of the fall is great there may be posterior displacement and angulation of the distal fragment at the fracture site There may also be radial displacement of the distal radial fragment and there may be associated fracture of the distal styloid of the radius (Fig 29 13) In these cases there is impaction of the fragments and often considerable comminution of the posterior cortex of the radial fragments The usual Colles fracture with displacement presents the typical silver fork deformity

Treatment

If the fracture through the radius is not displaced and there is no deformity it is necessary only to immobilize the wrist from the midpalmar flexion crease of the hand to a point below the elbow, allowing free motion of the elbow and the fingers In spite of the fact that there is no displacement at the time the patient is originally seen absorption may take place along the posterior cortex so that an angulation occurs sometimes associated with a shortening of the radius It is therefore wise to immobilize the wrist in partial flexion in an effort to prevent this deformity from occurring within the plaster When there is deformity with shortening of the radius angulation, and displacement these must be corrected

Technique of Reduction

After anesthesia, which may be general or local the patient is placed supine on an operating table with an assistant applying

countertraction to the elbow The operator then reduces the shortening of the radius by gentle continuous steady traction in the long axis of the arm It is important that the impaction of the fragments be corrected by this traction before any manipulation is attempted If an attempt is made to correct angulation and posterior displacement before the fragments are fully disimpacted the ends of the fragments may be damaged When the operator is convinced that the impaction has been corrected he proceeds to correct the posterior tilting as well as the posterior displacement of the distal fragment by molding the fragments The hand is held in partial flexion in ulnar deviation It is unnecessary and unwise to force flexion and ulnar deviation, since this position is uncomfortable for the patient and does not permit full flexion of the fingers If the x ray film shows good reduction (Fig 29 14) immobilization is then achieved by means of the application of anterior and posterior molded splints of about 10 layers of plaster strips for each



Fig 29 13 Colles fracture *A* Anterior posterior view showing fracture of lower end of radius with impaction and shortening and slight radial displacement of distal fragment There is also a fracture of the ulnar styloid *B* Lateral view showing posterior displacement and dorsal tilting of the lower fragment

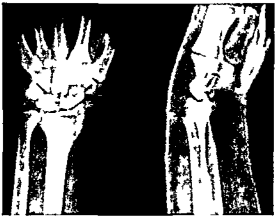


Fig 29 14 Anterior posterior x ray on left shows correction of the shortening impaction and radial displacement On the right in the lateral view the impaction posterior displacement and tilting of the distal fragment have been corrected Note the position of partial flexion and ulnar deviation in plaster

splint The arm should be covered with stockinet and the ulnar styloid protected with a square of felt cloth The plaster is molded carefully over the forearm and wrist to maintain proper flexion and ulnar deviation The ends of the splints are carefully placed so that the dorsal splint does not extend beyond a point just proximal to the metacarpophalangeal joint and the volar splint should not extend further than the midpalmar crease The splints are secured by means of a wet gauze bandage and the molding of the splints continued until the plaster is set The original wet gauze bandage is then divided and removed and dry gauze bandage used to secure the splints If the original wet gauze bandage is allowed to remain in place it may become set and cause too much constriction as it shrinks It is important to make certain that there is free motion of the fingers and thumb immediately after the application of the plaster The edges of the splints are then covered by rolling back the stockinet which is then fixed to the plaster by means of a single layer of plaster strip An x ray film is taken after application of the plaster to check position of the fragments If local anesthesia has been used and the patient is not to be admitted

to the hospital a sling is applied and the patient is instructed to elevate the arm as much as possible during the first 24 hours He is given explicit directions concerning the exercise of the fingers and is instructed to return on the following day for cast check At this time the condition of the hand and fingers is noted, and if there is any swelling the bandage is removed and the splints loosened and rebandaged

If there is considerable comminution of the fragments or if the original displacement was marked it is wise to apply either a splint incorporating the elbow or to apply anterior and posterior splints above the elbow to the midupper arm

After inspection in 3 or 4 days the original swelling will have receded and it is then possible to circularize the splints with a minimum of circular plaster so as not to increase the weight of the cast After this first visit, the patient is seen at least once a week, and splints are not removed for 5 or 6 weeks If the elbow is not immobilized the patient must be instructed to remove the arm from the sling and to exercise the elbow and the shoulder daily When the splints include the elbow joint the plaster may be shortened after a period of 3 or 4 weeks to allow motion of the elbow X-ray examination should be made at each visit and only if there is a marked change in position should any remanipulation be attempted A certain amount of recurrence of the original displacement within the plaster is inevitable in many cases, particularly in those in which there has been much comminution It is preferable to concentrate on the function of the fingers rather than to attempt to achieve a perfect anatomic result

In some instances it may be necessary to use skeletal traction to the proximal phalanx of the thumb to maintain reduction This procedure may result in a disability of the thumb if great care is not used in inserting the wire through the proximal phalanx, and the traction should not be continued for longer than 4 weeks lest loss of function of the thumb result

In some cases marked comminution and displacement may be an indication for the use of internal fixation by means of cross Kirschner wire fixation in which the wire is driven across the intact ulna into the distal radial fragment If properly placed these wires afford good immobilization so that early finger and wrist motion may be encouraged

After removal of immobilizing apparatus, the patient is instructed in exercises primarily directed toward motion of the fingers although it is also necessary to exercise the wrist joint Motion in this joint is more easily regained than in the fingers Baking massage and forced motions of the joints of the fingers or the wrist are contraindicated and it is only through the conscientious effort of surgeon and patient that full function of the hand is regained Since many of the patients resist active motion and are fearful of exercises, it is the surgeon s responsibility to see the patient often enough that he can be certain that the proper amount of exercise is being performed Reliance on physical therapy modalities such as diathermy baking and massage is useless in most instances, and function of the hand is regained in spite of this treatment Warm water soaks are harmless and sometimes soothing to the patient and are recommended

Complications

Persistent pain in the wrist, particularly in the course of the median nerve may indicate a neuritis and in some instances operative intervention with division of the transverse carpal ligament is indicated This however is rarely necessary

Rupture of the extensor pollicis longus tendon occurs in a small number of cases Although usually termed spontaneous this is probably the result of partial division of the tendon at the time of the accident followed by a severing of the remaining strand 3 or 4 weeks later resulting in the sudden loss of power to extend the thumb This requires operative repair of the tendon Usually this is accomplished by means of



A B

Fig 29 15 *A* Malunion following unreduced Colles fracture with prominence of lower end of ulna and radial deviation of hand *B* After removal of distal segment of ulna

end to end suture but occasionally if the ends of the tendon are so frayed that they make this operation impossible the extensor indicis proprius tendon may be used as a transplant

If the shortening of the radius recurs to such an extent that there is marked radial deviation of the hand and marked prominence of the lower end of the ulna the Darrach operation in which the lower end of the ulna is excised may be performed (Fig 29 15) About 1 in of the ulna is excised performing an osteotomy on the ulna with a slight obliquity from outside in so as to leave the lower end of the ulna as smooth as possible This operation should not be attempted until many months after the removal of the wrist from immobilization and until function of the fingers is complete In many instances patients do not feel the operation is justifiable since the deformity of the lower end of the ulna is the only remaining disability

Fracture of the Vertebrae

A common fracture sustained in the elderly is the compression fracture of a vertebra usually the lower dorsal or upper lumbar as a result of a compression force The elderly patient with decalcified bones or senile osteoporosis who has pain in the back after a minor accident deserves x ray examination Some of these compression fractures occur with so little trauma that the actual cause of the injury is not remembered by the patient The commonest cause of this fracture is the sudden jolt sustained when an elderly person is thrown upward from his seat while in an auto striking an unsuspected bump in the road Another cause of this accident is the lifting of a heavy window or a heavy object X ray examination shows a compression and resultant wedge shaped deformity of one or more of the lower dorsal or upper lumbar vertebrae (Fig 29 16) On occasion there may be an injury to one of the upper dorsal vertebrae but these are less common than injuries to the lower dorsal and upper lumbar vertebrae There may also be a biconcave deformity owing to the vertical compression of the soft bone by the nucleus pulposus above and below

Patients will usually complain of pain in the region of the injury and this may be very severe for the first few days or few weeks There are rarely any pressure symptoms involving the nerves or any evidence of spinal cord injury

Treatment

It is unnecessary and unwise to make any effort to correct the deformity of acute crush fractures of the spine and it is seldom neces



Fig 29 16 Compression fracture of twelfth dorsal vertebra sustained in woman of 80

sary to apply a plaster jacket Rest in bed is all that is necessary, but the patient should be ambulated as soon as he is able to walk without unusual pain Usually a well fitting, old fashioned corset with metal stays is all that is needed to give the patient some support to the spine on ambulation These elderly patients refuse to wear any extensive apparatus, such as braces or plaster casts The treatment should be entirely symptomatic and increasing ambulation should be encouraged In most instances compression fracture of the spine in this type of patient heals quickly, and the symptoms disappear after a period of a few weeks or a few months Rarely the symptoms persist so that the patient may need to be fitted with a light spinal brace

Fractures and Dislocation of the Upper End of the Humerus

The next most common fracture sustained in the elderly is one which is rare in the young individual This is the impacted fracture of the surgical neck of the humerus

The elderly patient falls on the extended hand causing a crushing force at the surgical neck of the humerus thus forcing the cortex of the shaft into the softer cancellous bone of the head (Fig 29 17) In most instances the impaction is great enough to fix the fragments one into the other so that there is no motion at the fracture line The patient has severe pain in the shoulder region and a considerable amount of swelling may result from hemorrhage After a day or two ecchymosis may appear and may become so extensive as to include the entire upper arm to the elbow and occasionally into the forearm

In this instance motion of the shoulder joint is the most important objective to be considered in the treatment It is essential that no effort be made to disimpact the fragments Regardless of the deformity at the fracture line, the most bizarre appearing fractures in this region usually heal with good motion if progressive treatment is instituted

Treatment

Since it is traditional to expect a plaster cast whenever a fracture is sustained it is with great difficulty that the elderly patient



Fig 29 17 Impacted fracture of surgical neck of humerus

can be convinced that early active free motion is the only treatment for this injury Immobilization of the arm and shoulder to the body by means of Velpeau s bandage or by means of sling and swathe is contraindicated It is necessary only to apply a sling and the arm should be free to make movement of both shoulder and elbow possible There should be no bandaging and the clothing should be so worn as to not immobilize the shoulder In the first few days after the accident occurs it is of course impossible to expect the patient to move his arm freely It is necessary however that he move his arm to even small degrees of motion both at the shoulder and the elbow so that full motion can be more quickly achieved The use of hanging casts in this type of case is definitely contraindicated since it is not only theoretically unsound to apply traction to this fracture in which impaction should be maintained but the heavy plaster only further fatigues the shoulder girdle muscle and unnecessarily immobilizes the elbow and wrist Most patients seem to show great fondness for the hanging cast or any other immobilizing apparatus and strongly resist motions of the arm It is the responsibility of the surgeon to explain the situation dispel the patient s fears and convince him that active motion is the best form of treatment

The patient should be seen frequently and should be meticulously instructed in exercises that should be performed many times daily The most important single exercise involves the use of the abductor muscles of the shoulder These muscles are quick to atrophy and it is difficult for the patient to contract the muscles even to a minimum degree The so-called *pendulum exercise* in which the patient leans forward and the weight of the arm is used to move the shoulder in a circular direction is really a passive exercise which does not contract the muscles and does not achieve the result desired The pendulum exercise is useful in proving to the patient that the shoulder joint can move but without active use of the muscles of the shoulder full function cannot be achieved for a very long time

Under ordinary conditions abduction to the shoulder level cannot be expected for at least 6 to 8 weeks from the date of the accident It is only through constant effort that further motion can be achieved even in the most responsive and cooperative patient In those patients who refuse their active exercises marked limitation of shoulder joint may be expected The elbow joint as well as the wrist hand and fingers should be exercised daily since the patient is likely to prefer that the entire limb be immobilized constantly

Dislocation of the Shoulder

Dislocation of the shoulder is treated just as in the young adult except that no effort is made to immobilize the shoulder after the reduction Ordinarily reduction can be accomplished without anesthesia with only a small dose of Demerol or morphine Gentle continuous pull on the extended arm is all that is necessary to reduce these lesions No great force should be exerted and no effort made to use a manipulative reduction such as Kocher s maneuver The muscles are easily fatigued and the reduction is best accomplished by the Hippocratic method

After reduction the arm is placed in a sling and active exercises encouraged and insisted upon just as has been described for the fracture of the surgical neck of the humerus

Unreduced Dislocations

Occasionally an elderly patient sustains a dislocation but does not realize the severity of the injury and receives no treatment He may then appear many weeks later with limitation of motion in the shoulder and an obvious unreduced dislocation In many instances in the very elderly the limitation of motion is not great and if there is no evidence of encroachment on the axillary structures causing pain or swelling of the lower arm it may be unwise to attempt re-



Fig 29 18 *A* Typical anterior dislocation of shoulder in elderly female reduced immediately *B* X ray examination 10 days later shows apparent subluxation *no symptoms* *C* Two weeks later normal position of head in relation to glenoid

duction In most instances closed reduction under general anesthesia is unsuccessful and the operative procedure is difficult and often unsuccessful

Fracture dislocations of the shoulder in elderly persons where there is a dislocation of the head of the bone and a fracture of the shaft of the humerus may necessitate immediate operation if closed reduction proves unsuccessful Occasionally excision of the humeral head is the operation of choice In many instances the fracture may be immobilized by means of intramedullary rod or rods of the Rush type and reduction maintained These usually result in some limitation of motion in the shoulder

After dislocation of the shoulder or impacted fracture of the surgical neck x ray examination may show an apparent subluxation of the head from its normal position with the glenoid (Fig 29 18) The unwary may feel that there is a partial dislocation which should be reduced but will find that attempts to do so are unsuccessful The authors term this condition *pseudo subluxation* since it is the result of weakness of the shoulder girdle muscles This allows gravity to lengthen the muscles and thus to cause the appearance of a subluxation After recovery of muscular power in the shoulder the relationship of the humerus to the glenoid returns to normal

Fractures of the Shaft of the Humerus

Fractures of the shaft of the humerus occur less frequently than those of the upper end of the humerus Ordinarily there is either an oblique or transverse fracture of the middle of the shaft with some angulation but rarely any overriding

The objective of the treatment of this lesion is again the maintenance of joint motion and any efforts to immobilize the fracture should not interfere with motion of the shoulder elbow and fingers

The most effective treatment is the use of the collar and cuff, with coaptation splints applied to the upper arm A muslin bandage well padded to prevent pressure is used as a collar around the neck and a padded cuff is applied to the wrist The wrist cuff should be wide enough to allow support of the hand as well as the wrist and should be large enough so the patient can easily remove the hand from the cuff and exercise the elbow and wrist The arm is placed with the elbow flexed in a right angle and no attempt is made to support the forearm with a sling The patient usually has considerable pain swelling and ecchymosis at the fracture site and for the first several days he must sleep in a reclining or sitting position He should be instructed to allow the arm to remain suspended in the collar and cuff as much as possible Usually after a period

of a week or 10 days the discomfort gradually subsides and the patient is quite capable of ambulation It is essential that the arm be removed from the apparatus at frequent intervals during the day so that the elbow may be exercised It is also necessary that the patient be instructed after a week or 10 days to begin active motions and exercises of the shoulder joints like those described in treatments of impacted fractures of the neck of the humerus

The hanging cast is popular in this type of fracture but is definitely contraindicated particularly in the elderly since there is no need for continuous traction as the muscles are weak and overriding is rarely great As a matter of fact the healing is more rapid and more certain if there is a certain amount of overriding and the small amount of shortening which results is never discernible The hanging cast is very uncomfortable is quite likely to cause distraction of the fragments and may cause peripheral nerve involvement by its pressure Furthermore immobilization of the elbow and continuous pull on the shoulder joint cause complications in these joints

Healing is usually rapid and after a period of 3 weeks the fracture is usually solid During the first week or 10 days of the treatment the patient is often quite apprehensive and obvious motion at the fracture line causes considerable worry both to him and to his family The application of coaptation splints to the upper arm is helpful in preventing gross angulation and motion at the fracture site and finally gives the patient a greater feeling of security Occasionally it is necessary to apply splints to immobilize the elbow for a period of a week or 10 days

In some instances operative reduction and internal fixation by means of the intramedullary rod preferably the Rush rod is indicated In most instances the intramedullary canal is quite wide and it may be necessary to insert two rods through the region of the greater tuberosity to immobilize the fragments firmly Among the elderly operative intervention in these cases should be undertaken only in a rare case where there is contraindication to other forms of treatment

Supracondylar Fracture of the Femur

Fractures in this region are common in the elderly particularly in those who have a preexisting disability of the knee or the hip The fragile cortex of the femur is easily fractured when excessive leverage is placed at the supracondylar region owing to a partially ankylosed knee or hip Most of these injuries are sustained as a result of a simple slip or fall in the home and are rarely associated with severe shock or other multiple severe injury If there has been a marked limitation of the motion of the knee there is rarely much displacement of the fragments of the fracture Occasionally there is a posterior displacement of the distal fragment which endangers the popliteal vessels and for which prompt reduction and immobilization are necessary

The primary objectives in the treatment of this fracture are preservation of life preservation of limb healing with stable weight bearing and maintenance of knee and ankle motion

Since many of these patients do not tolerate long immobilization in plaster or traction it is necessary to use a method of treatment which allows early ambulation if this is possible However operative procedures on these patients are fraught with danger since the cortex of the femur is fragile while internal fixation is difficult to achieve without the addition of external immobilization It is therefore necessary to compromise in the treatment and to achieve the most important objective even though another objective may have to be sacrificed

Treatment

Plaster Immobilization If there is ankylosis of the knee joint immobilization in plaster may be the treatment of choice This is particularly applicable in those cases in which the patient has been immobilized by reason of rheumatoid arthritis or other anky

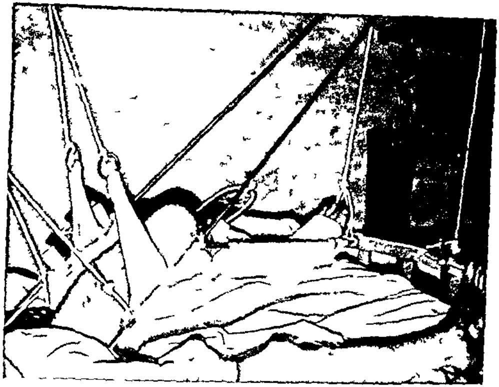


Fig 29 19 Supracondylar fracture treated by skeletal traction inserted through the tibial tubercle Note sling to correct posterior angulation at fracture line

losing diseases and can be treated satisfactorily in plaster

Traction Skeletal traction with wire placed through the tibial tubercle and the limb suspended in a Thomas splint is the *treatment of choice in most instances (Fig 29 19)* If there is difficulty in correcting posterior displacement or angulation of the distal fragments (Fig 29 20) it may be necessary to use a sling under the fracture site (Fig 29-19) or on occasion a second wire in the supracondylar region Great care must be exercised to prevent pressure areas in the region of the application of the splint and in the sacral region The patient must be moved from side to side frequently and the skin must be cared for meticulously

Russell Traction Russell traction is rarely indicated in the treatment of these fractures because of the difficulty of reducing the posterior angulation and because of the danger of pressure in the popliteal region caused by the traction sling

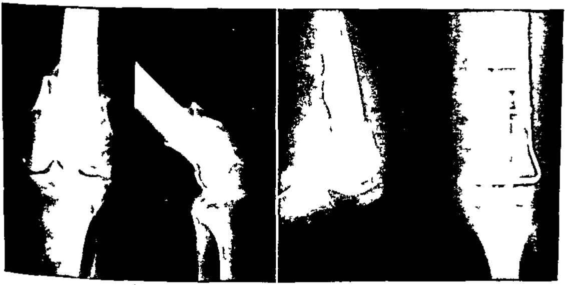
Internal Fixation Operative reduction of these fractures is sometimes necessary since no other form of treatment will achieve replacement of the fragments This is particularly true in cases where there is an intercondylar fracture with displacement of one or both condyles (Fig 29 21*A*) Operation may be performed through either a *lateral or a medial approach depending* upon the site of the fracture A form of angle plate or bar is a most efficient means of fixation The modified Blount nail is inserted through the condyles of the lower fragment and the plate affixed to the shaft (Fig 29 21*B*) Because of the danger of rotation of the lower fragments, it is sometimes helpful to insert a screw or web bolt into the distal fragment or fragments as well as the angle plate This will prevent rotation

Since the cortex may be excessively thin the fixative material may easily pull through and extrude through the bone When bolts and plates are used it is necessary that large washers be used at either end of the bolt so that the bolt head or nut does not pull through the cortex It is rarely possible to depend upon internal fixation without some form of external immobilization by means of plaster therefore operative procedure



A B

Fig 29 20 Supracondylar fracture *A* In traction showing posterior angulation *B* After application of sling as pictured in Fig 29 19



A B

Fig 29 21 *A* Supracondylar fracture of femur in elderly female with impaction and marked comminution of fragments *B* Fracture immobilized by modified Blount plate

does not usually offer the important advantages of mobilization and ambulation

The postoperative care of these patients is important particularly since most of them are confined in plaster, and they must be turned frequently After removal from the plaster great care must be taken that they do not put unnecessary leverage on the fracture site since refractures are very apt to occur After removal of the plaster knee exercises are important and other exercises should be continued throughout the period of immobilization In most instances some limitation of motion of the knee joint is inevitable but ordinarily 90° of flexion may be expected

Fractures of Both Bones of the Forearm

Fractures of both bones of the forearm are not as common in the elderly as are other fractures of the upper extremity but when they occur they need particular attention If it is possible to reduce the fractures by manipulation under anesthesia and to maintain the reduction in plaster immobilization from the midpalmar crease in the hand to a point high in the upper arm is a good method The primary immobilizing plaster must be applied in the form of splints held in place by gauze bandage It is only after the swelling has diminished after the first few days that the plaster can be safely circularized The forearm should be supinated in those places where the fracture occurs above the middle of the bones but it should be immobilized in the midposition when the fracture occurs in the lower half of the bone The elbow should be fixed at 90° and the wrist at midposition with particular attention to releasing the fingers so that active motion can be instituted immediately and continued throughout convalescence

In many instances as in younger individuals fractures of the forearm are difficult to reduce and it is sometimes impossible to maintain the reduction in plaster It is therefore often necessary to perform an operative reduction and internal fixation The healing in the radius and the ulna may be slow, and the use of plates in the forearm for immobilization is often unsuccessful The authors recommend the use of intramedullary nails of the Rush type and they find that, if they are properly applied immobilization in plaster is necessary for a few weeks only and the elbow and wrist may be mobilized after 3 or 4 weeks even though sound healing has not yet occurred When intramedullary rods are used it is wise to evaluate the size of the intramedullary canal in both bones since even in older individuals the canal might be quite small although the rule is the older the person, the larger the intramedullary canal If the canal is large it may be necessary to use an unusually large rod However small diameter rods of proper length should be available so that firm immobilization may be established It is unwise to attempt to immobilize either bone of the forearm with nails that are too short

The nails should be inserted from the distal end if the fracture is in the lower or distal third of the bone (Fig 29 22*A*) The radial styloid can easily be exposed through a transverse incision and a hole is started in the cortex by means of a sharp pointed Steinmann pin Following this a drill can be used to prepare an oblique opening into the intramedullary canal of the radius The Rush nail should be curved slightly so that it may more easily enter the canal The nail should be long enough to extend almost into the neck of the radius The styloid of the ulna may be exposed and the drill hole made directly into the distal end of the ulna In this instance also the nail should extend into the proximal portion of the bone

When the fracture is near the middle of the bone or in the proximal half the ulnar nail may easily be inserted through the olecranon care being taken to sink it into the cortex of the bone so that it will not cause pressure in a subcutaneous position The fracture of the radius can be immobilized by inserting the nail through its distal end only

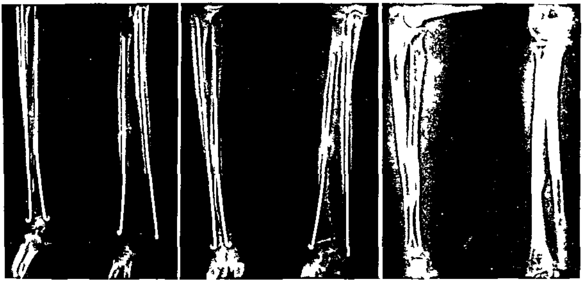


Fig 29 22 *A* Fracture of both bones of forearm with insertion of Rush nails from below *B* Healed fractures with pins *in situ* *C* Result 1 year later after removal of nails

If after insertion the nail seems to be firmly seated and immobilization is good external immobilization may not be necessary except for a few days for the soft parts to heal The most important postoperative therapy is that directed toward mobilization of the fingers The patient must be instructed encouraged and coerced into frequent daily exercises of the fingers As soon as the immobilization is removed he must be encouraged to exercise the elbow At all times the patient should be instructed to remove the arm from the sling and to abduct and elevate the arm so that motion in the shoulder is not restricted After the fractures have healed it is usually wise to remove the intramedullary rods since they may cause irritation at the tip of the olecranon or at the radial styloid Healing may take a long time and it may not be possible to remove the nails for a period of 6 months to a year (Fig 29 22C)

Fractures of the shaft of the radius alone or the ulna alone are best treated by means of the intramedullary rod thus assuring immobilization for a prolonged period without immobilizing the joints of the wrist and elbow These fractures of the single bone are apt to be even more prolonged than the fractures of both bones and healing may be extremely slow

Fractures of the Pelvis

Fractures of the pelvis among the elderly are usually cracks through the pubis or occasionally through the ischium without displacement and if there are no complicating injuries to the genitourinary system their treatment should be only symptomatic The patient is treated by rest in bed only without encircling strappings or slings and he is encouraged to move about in bed limited only by the amount of pain he suffers As soon as he is able he is moved out of bed into a chair and partial weight bearing is begun as soon as possible Full weight bearing may be allowed as soon as the patient is able to walk without pain One may have no fear of displacing fractures of the pelvis in the elderly if there has been no displacement as a result of the initial trauma Furthermore these fractures heal rapidly and well and rarely leave any disability

Fracture of Both Bones of the Leg

Fractures of both bones of the leg are less common in the elderly than other fractures of the lower extremity since the upper end

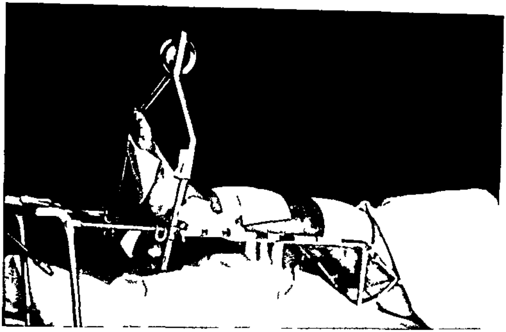


Fig 29 23 Open fracture of both bones of leg treated by skeletal traction through os calcis and suspension on Braun Bohler frame

of the femur and the supracondylar region are more susceptible to strains and stresses of ordinary falls Occasionally the elderly person sustains a fracture of both bones of the leg as a result of an automobile injury or other violent trauma and the treatment is essentially the same as that of the younger individual, except that one must use every means to allow the patient to be ambulated early so that he will not be confined to bed in traction apparatus

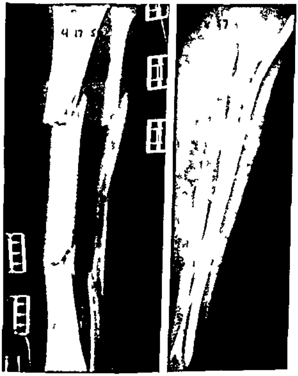


Fig 29 24 Segmental fracture of tibia treated by Lottes nail

Usually a satisfactory reduction can be achieved by manipulation and immobiliza tion may be maintained by long light plas ter Plaster should be made light and great care should be taken that there be no pres sure areas over the bony prominences The patients should be encouraged to walk with crutches as soon as possible If it is neces sary to immobilize the limb with flexion of the knee the first splint should be removed and long light plaster with a walking heel be applied as soon as possible The patient is then able to bear some weight on the limb and will be able to manipulate more easily with the crutches

In some instances traction is the prefer able type of treatment A wire through the os calcis with the limb elevated with flexion of the knee and the hip in a Braun Bohler frame is the method of suspension which is easiest for the elderly person to tolerate (Fig 29 23) It is difficult for the older



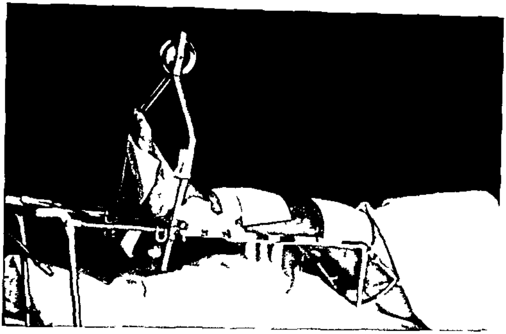


Fig 29 23 Open fracture of both bones of leg treated by skeletal traction through os calcis and suspension on Braun Bohler frame

of the femur and the supracondylar region are more susceptible to strains and stresses of ordinary falls Occasionally the elderly person sustains a fracture of both bones of the leg as a result of an automobile injury or other violent trauma, and the treatment is essentially the same as that of the younger individual, except that one must use every means to allow the patient to be ambulated early so that he will not be confined to bed in traction apparatus

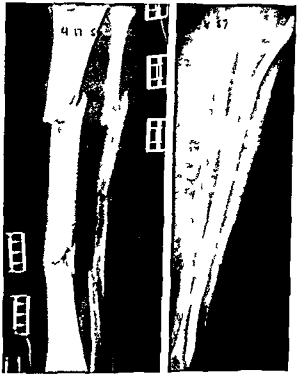


Fig 29 24 Segmental fracture of tibia treated by Lottes nail

Usually a satisfactory reduction can be achieved by manipulation and immobilization may be maintained by long light plaster Plaster should be made light and great care should be taken that there be no pressure areas over the bony prominences The patients should be encouraged to walk with crutches as soon as possible If it is necessary to immobilize the limb with flexion of the knee, the first splint should be removed and long light plaster with a walking heel be applied as soon as possible The patient is then able to bear some weight on the limb and will be able to manipulate more easily with the crutches

In some instances traction is the preferable type of treatment A wire through the os calcis with the limb elevated with flexion of the knee and the hip in a Braun Bohler frame is the method of suspension which is easiest for the elderly person to tolerate (Fig 29 23) It is difficult for the older



A *B* *C*

Fig 29 25 *A* Nonunion of 8 months duration of shaft of humerus in patient aged 82 years *B* After insertion of two Rush nails and application of autogenous cancellous bone graft *C* Final result 1 year later after removal of nails

individual to remain in a Thomas splint although this may be used if care is taken to prevent pressure on the thigh

Operative intervention with internal fixation by means of intramedullary rods is occasionally indicated in the elderly but because of the fragility of the bones and the difficulty in inserting the nail it is not as useful a procedure as in the younger patient Occasionally segmental fractures of the tibia are best treated by means of the Lottes nail (Fig 29 24)

Nonunion

Although there is a popular conception that the bones of the aged heal slowly one may expect that the elderly person s bone will heal just as rapidly as those of a younger person However if the fracture occurs through a decalcified bone in the patient with senile osteoporosis then the new bone which is formed will also be deficient in calcium and therefore more brittle than normal bone Furthermore when fractures occur through pathologic areas such as those in Paget s disease and in metastatic carcinoma the healing will be slower than normal and the resulting callus will often be pathologic In the case of metastatic lesions however the healing of the fractures may make the bone stronger than it was previously and much of the destroyed bone may be filled in by new bone

Since elderly persons are prone to sustain injuries in the region of the intracapsular area of the neck of the femur and since these have a poor prognosis at any age the problem of nonunion at this site is of course quite common The treatment of nonunion of this fracture has been described under the section on fracture of the neck of the femur

Nonunion in other long bones such as the humerus both bones of the forearm and the femur should be treated by operation and grafting even though the patient may be elderly It is not justifiable to condemn the patient to disability of the limb for the rest of his life because of his age

Nonunion in the humerus should be operated upon by exposing the fracture site *freshening the eburnated ends of the fragments* and shortening the limb to ensure impaction of the fragments The best method of immobilization is through the use of intramedullary rods if the intramedullary canal of the humerus is large it may be necessary to use two Rush rods or nested Kuntscher nails (Fig 29 25)

BIBLIOGRAPHY

Bick E M General Principles of Fracture Management in the Aged Surg Gynec & Obst 106 343 1958

Bohler L *The Treatment of Fractures* 5th ed Grune & Stratton Inc New York 1956

Jewett E L Rigid Internal Fixation of Intracapsular Femoral Neck Fractures Am J Surg 91 621 1956

Key J A and Conwell H E *The Management of Fractures Dislocations and Sprains* The C V Mosby Company St Louis, 1951

Moore A T The Self Locking Metal Hip Prosthesis J Bone & Joint Surg 39A 811 1957

Pugh W L A Self Adjusting Nail Plate for Fractures about the Hip Joint J Bone & Joint Surg 37A 1085 1955

Watson Jones R *Fractures and Other Bone and Joint Injuries* 4th ed The Williams & Wilkins Company Baltimore 1955

30

Plastic and Reconstructive Surgery

Herbert Conway

INTRODUCTION

As persons grow older their need for plastic and reconstructive surgery is likely to increase. This chapter will discuss in detail the particular infirmities which most commonly call for the techniques of plastic surgery in the aged and will point out the special details of management required in the treatment of trauma or acquired disease.

In general, the aged frequently require plastic and reconstructive surgery for the following categories of trauma and acquired disease: (1) injuries to the head and neck which not only differ in type from injuries among younger persons but which also present problems associated with the early development of the state of shock and with the later development of fluid imbalance and/or malnutrition; (2) tumors of the skin and of the oral cavity which present variations in the aged that must be considered if effective care is to be administered; (3) cosmetic problems where seriousness depends upon the degree of altered appearance, the patient's occupation or avocation and his psychological state; these largely determine the extent of his activity and his ability to adjust to aging. The feasibility of elective cosmetic surgery must be weighed carefully in the light of the older patient's diminished physical reserve. The anatomic and physiologic changes in the structure of the skin will be described and will be illustrated by photomicrographs of specimens secured from subjects of succeeding age decades.

Especially impressive in the field of trauma are the lessened ability of the older subject to withstand the traumatic, toxic and septic assault of burns and the relative magnitude of facial fractures in the older person as compared with the younger. In considering tumors of the skin, one must remember that in older persons these are often in effect degenerative diseases. Some investigators believe that carcinoma of the skin does not occur in normally aging skin. Moreover, mortality rates (based upon relative malignancy of cutaneous cancers) vary according to age decades. Degenerative states in mucous membranes lead to leukoplakia, lichen planus, and other conditions which are precursors of carcinoma. Some investigators consider these conditions to be due to relative nutritional deficiencies. Older persons are especially prone to develop such difficulties because their diets may not be properly supervised, their social lives are not conducive to the stimulation of appetite, and the reduced metabolic activity of the gastric mucosa diminishes hunger, thus making it difficult for the patient himself to recognize his own nutritional needs. In the management of the aged patient who must undergo surgery for cancer of the skin or of the oral cavity, it is important to provide strong reassurance. Fear of the operative procedure itself and of the outcome adds seriously to the basic insecurity of the

aged subject If the individual about to embark on a course of reconstructive surgery is informed about *the type of anesthesia, the* number of planned operative procedures, and the degree of discomfort he may anticipate he will develop confidence in his future Usually such an approach, not unlike that required in the care of children will be rewarded by a trusting faith in the surgeon

Cosmetic conditions requiring surgery of the skin stand alone as altered states which are limited to the aged, if the term be applied to physiologic as well as to chronologic age Attention to this area of surgical practice can be expected to do much to rehabilitate the aged subject and to make him more presentable, more happy and ultimately more useful Loneliness idleness reduced income dejection, depression, and undesirability *in industry, community, and family* may all be favorably affected by surgical procedures directed at the improvement of facial appearance Thus, the importance of cosmetic surgery in the older subject is real and the scornful frown of the average physician at the uselessness of cosmetic surgery is no longer justified

ARTERIOSCLEROSIS, AGE, AND THE TRANSPLANTATION OF TISSUE

In the transplantation of tissue by pedicle flap the surgeon is concerned with the prompt development of collateral circulation both in the defined pedicle and *in its* attachment to the recipient wound Thus any pathologic change which alters or slows this development of collateral circulation may militate against the success of the procedure Arteriosclerosis is one of these changes Loose language tends to refer to all elderly persons as arteriosclerotic This is a mistake for just as there are various types of arteriosclerosis so are there varying degrees of impairment of peripheral arterial flow, not necessarily linked with progressive age decades Arteriosclerosis includes atherosclerosis, looked upon generally as an abnormality of lipid metabolism *and deposit* not always in association with progressive age, Monckeberg type of sclerosis which usually occurs in the lower extremities, affects the media of the vessels rather than the intima and results in horizontal *ringlike calcifications of the vessels*, but which does not in itself narrow the lumina arteriolarsclerosis, usually associated with hypertension, which often occurs in *young persons and affects the smaller blood* vessels of the arterial tree and finally *the* type of arteriosclerosis which occurs with aging where the classic senile arteriosclerotic changes are observed Through calciferous deposits in the intima of the vessels, this last type causes significant impairment of peripheral flow of blood even to the extent of arteriolar and arterial obliteration This is the type of arteriosclerosis which concerns the reconstructive surgeon when he attempts the transfer of soft tissues in the aged In this condition the elastic tissue of the media undergoes degenerative changes so that the arteries and arterioles become tortuous as well as dilated thus causing elongation in addition to dilatation A readily visible ex*ample of this condition in older subjects* is the tortuosity of the temporal arteries The vascular efficiency of such arteries is decreased and regional cellular nutrition suffers Here, as in complex problems of management in younger subjects, the surgeon must rely on a physiologic test in order to assay the circulatory efficiency in a con*structed pedicle These tests* patterned after those employed for the assay of circulatory efficiency in peripheral vascular disease give accurate information Of all of the tests available the *histamine wheal test is the simplest and the most informative* To determine whether a given pedicle may be divided after migration on any day from the fourteenth to the twenty first after its isolation by incision the surgeon applies a tourniquet to one of its ends scarifies the skin of its most distal portion and applies histamine (a drop of the acid phosphate salt

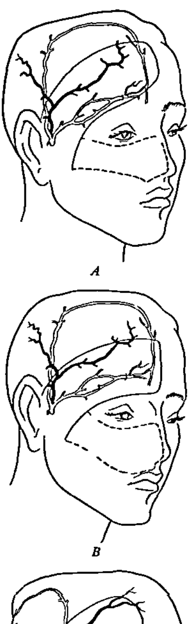


Fig. 30-1 Illustrated are the variations of the outline of temporal flaps and their application in the correction of defects of the nose cheek, and lip *A* and *B* Anterior temporal flaps must include the frontal branch of the temporal artery and the supraorbital vein *C* Posterior temporal flaps or scalp flaps should include the parietal branch of the temporal artery and the superficial temporal vein (*Reproduced from H Conway R B Stark and J D Kavanaugh Variations of the Temporal Flap Plast & Reconstruct Surg 9 410 1952 with permission of the Journal and authors*)

of histamine 1 1 000 solution) The number of minutes required for the development of a cutaneous wheal in the tissue under observation is then compared with a control area as an index of circulatory efficiency in the transplant In normal healthy adults this time is 8 minutes In an aged subject one must be mindful that circulatory efficiency may be impaired generally and the appearance of the wheal may be delayed even in the control area Good judgment must be exercised in determining the earliest possible date after migration on which a given pedicle may be divided safety Yet with the histamine wheal test as an index the surgeon employs a measure of safety which is reflected in fewer complications and in the limitation of the number of days between operative procedures

Other factors must be considered in managing massive soft tissue transplants in the aged Serum proteins should be held at the optimum by suitable therapy hydration should be kept at the ideal by supportive fluid therapy and it is an axiom that pedicle transfers must be planned to avoid the immobilization of any joints during the 2 to 4-week period of transfer Static arthritis commonly produced by such immobilization may so cripple the aged subject that an infirmity greater than that under treatment is produced Subdeltoid bursitis can be induced in the same way and so in treating the aged subject it is wise to avoid any procedure which may immobilize the shoulder joint even for a brief period of time Fortunately the majority of pedicle flaps in the aged are required by reason of defect on the face Usually caused by excisional

surgery for carcinoma but occasionally by the effects of trauma, these defects are commonly corrected effectively by the popular temporal flap This flap embodies the temporal artery as well as the temporal veins It may be migrated immediately (at one operation) even though its pattern includes tissue of the forehead beyond the midline and extending to the side opposite its pedicle *Details of the temporal flap are reported* elsewhere and are illustrated in Fig 30 1 Such immediate flaps, developed in and migrated to cephalic areas, are commonly used in older patients They are invaluable because they do not require the immobilization of joints and because the patient may be ambulatory within 24 hours after operation Ambulation is necessary in order to avoid venous stasis with the ever present possibility of embolic phenomena

INJURIES OF SOFT TISSUES AND BONES OF THE FACE

The frequency with which facial injuries occur in the aged is not only impressive but at first glance, surprising, since the older person is usually a quiet passenger not the driver of the car However statistics show that the unalert passenger is injured or thrown from the car more often than is the driver *Injuries to soft tissues of the face* of the older subject are likely to be associated with greater ecchymosis than those in younger persons Compared with those in younger persons, discolorations due to diapedesis of blood cells into the tissue are more marked more varied in hue extend farther into the tissues and are slower to resolve A common injury of the aged subject is the severe abrasion of the face in which particles of dirt have been ground into the dermis Such cases are treated effectively under local anesthesia by dermabrasion (Fig 30 2) thus avoiding the need for later cosmetic excision which usually requires skin grafting It is not uncommon to observe a laceration of the cheek which has caused the late appearance of blue purple black discoloration of the skin at quite a distance from the laceration, even as far down as the clavicular and upper thoracic areas Lacerations avulsion flaps, through and through wounds of the cheek and wounds with loss of tissue are treated exactly as they are in the younger subject When the loss of tissue is such that closure by suture cannot be accomplished easily a skin graft should be used Split skin grafts take very well in older subjects Apparently there is always sufficient circulation to permit early development of circulation in free grafts Shock and delayed shock must be watched for intently and therapy to reverse these altered states must be applied with caution Doses of opiates must be carefully established for the older subject may respond more effectively to a given dose of sedative than a younger one Intravenous fluids must be given only after careful consideration of the patient s cardiac status since the circulatory volume of a patient with diminished cardiac reserve can easily be overloaded by the introduction of a comparatively small amount of fluid Usually wounds of soft tissue may be repaired effectively under local anesthesia by injecting the Novocain into the skin so that it perfuses the tissues as it exudes from the surfaces of the open wounds This provides a technique of cleansing which cannot be improved Irregular jagged lacerations are fitted together like parts of a jigsaw puzzle without debridement of margins of the wound Avulsion flaps are replaced in normal position Sutures of No 00000 or No 000000 black silk are used for suture of the skin after meticulous hemostasis has been accomplished by clamp and ligature Through and through wounds of the cheek may be treated by loose suture of mucous membrane and of muscular planes followed by suture of the skin as described above If there is associated loss of tissue mucous membrane should be sutured to skin Salivary fistula and inordinate drying of the mucous membranes are probable sequelae of this technique, which is employed only



A B

Fig 30 2 *A* Severe abrasion of the face suffered when patient fell on asphalt pavement Numerous minute particles of dirt and foreign material were embedded in the dermis *B* Appearance 8 days after emergency treatment by abrasion using Novocain injection to the point of tense rigidity of the tissue the application of the rotary steel brush and petroleum jelly gauze dressing (*Reproduced from Conway H Injuries of Soft Tissues of the Face Am J Surg* 90 891 1955 *with permission of the Journal*)

as a temporary measure in order to avoid rampant infection of soft tissue Salivary fistula will rapidly affect the electrolyte and fluid balance in the aged subject For this reason wounds which have been treated by suture of mucous membranes to skin should be treated definitively by closure at the earliest possible time Drying of the mucous membranes in such cases provides an ideal background for the development of parotitis a complication which is common in the dehydrated older subject Infection should be guarded against by protective therapy with penicillin an antibiotic which is most effective against the bacterial flora of the mouth Antitetanic serum or booster dose of toxoid should be given Aged subjects should be ambulated promptly following surgery for wounds of soft tissues of the face

Fractures of the bones of the face in aged subjects are treated just as they are in younger subjects with certain important exceptions In the first place the relative rarefaction of facial bones in the aged makes it usual that fracture lines are literally pulverized rather than broken cleanly This means that the present trend toward open reduction by wiring of fractures of facial bones is even more applicable in older than in younger subjects Moreover many aged subjects are edentulous Fortunately operative trauma in this part of the body is withstood well by older people especially if it is carried out under local anesthesia Fractures of the facial bones should be reduced as early as possible in old people because firm union in malposition develops just as rapidly in the aged as in others *Fractures of the nasal bones* may be corrected by closed or operative reduction according to classic technique Splints of dental compound in association with intranasal packing usually hold the

reduced fractures effectively *Fractures of the malar bone* are best treated by open reduction with direct wiring (Fig 30 3) Attention must be given to the position of the eyeball for diplopia is a complication if it is dislocated downward *Fractures in the region of the maxillary antrum* are treated by packing the antrum through the classic Caldwell Luc incision In old people fractures of the maxilla cannot be treated by counter traction applied via a plaster head cap because these are never secure Open reduction must be resorted to with wiring of the maxilla to a fixed bony point above the line of fracture *Fractures of the mandible* are important because, if severe, they may cause *obstruction* to the upper respiratory tract As an emergency measure in sectional fractures the tongue must be pulled well forward and held in that posi



Fig 30-3 *A* Example of a severe soft tissue wound in association with horizontal fracture of the maxilla in a man 61 years old Emergency treatment included maintenance of airway by upward pressure on the upper jaw and the institution of tracheostomy *B* Lateral x ray film showing anterior displacement of the fractured maxilla *C* Lateral x ray film after reduction of the fracture and direct wiring plus the institution of fixation by interdental wires The wound was irrigated copiously with physiologic saline and the margins of the jigsaw puzzle which the jagged laceration presented were approximated by interrupted sutures of No 00000 and No 000000 silk Margins of the wound were not excised nor was it necessary to cut away any of the soft tissues There was complete absence (traumatic loss) of the nasal septum *D* Appearance shortly post operative *E* Appearance of the patient after primary healing *F* Appearance after subsequent admission to the hospital at which time a free graft of cartilage was inserted for support of the dorsum nasi (*Reproduced from Conway H Injuries of Soft Tissues of the Face, Am J Surg* 90 891, 1955 *with permission of the Journal*)

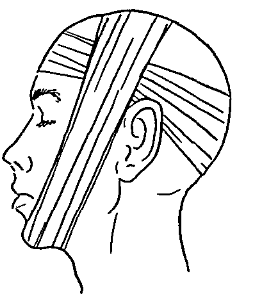


Fig 30-4 In the emergency care of extensive facial fractures the Barton bandage is an excellent temporary method of immobilization for purposes of transportation



Fig 30-5 Fractures of the jaw in the aged are often complicated by the fact that the patient is edentulous Immobilization of the fracture in satisfactory alignment can easily be carried out with the Gunning splint which is molded from dental compound or acrylic to fit the alveolar ridges of upper and lower jaws A Barton bandage secures the lower jaw in position

tion lest the relaxed epiglottis occlude the airway Reduction should be carried out as soon as possible If sufficient teeth are present the conventional method of reducing mandibular fracture by interdental wiring may be used In the edentulous subject reduction may be accomplished by direct wiring of fragments at operation by the use of Gunning s splint and Barton s bandage by circumferential wiring or by intramedullary pin fixation (Figs 30-4 to 30-6) Tracheostomy often necessary in the management of sectional fractures of the mandible is not tolerated well by the aged subject The tube gives a feeling of insecurity to the patient bronchial exudates are commonly tenacious and difficult of extrusion and the cough reflex is fatiguing

In the postoperative care emphasis must be placed upon the recovery of deglutition and mastication as soon as possible Thus operative reduction not only of maxillary but also of mandibular fractures becomes the treatment of choice in older persons Union of fractures of the facial bones in the aged does not vary from the normal expected period

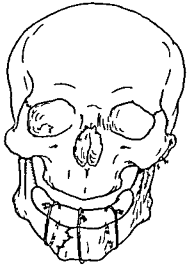


Fig 30-6 Immobilization of the mandible following fracture in the edentulous patient can be carried out by means of circumferential wiring around the jaw and acrylic splint as shown in the above sketch

BURNS

Data are now being accumulated to substantiate the long standing opinion of experienced clinicians that the mortality rate following burns in aged persons is very high Bull and Fisher presented a comparative table which showed that when burns in

volved 15 to 24 per cent of the surface area of the body, the mortality rate was 6 per cent in the 15 to 44 year age group, but 80 per cent in those 65 years of age or older This was supported by Moyer who reported that 50 per cent of persons over 61 with *burns involving 13 per cent of the body* died of the injury In the series of Bull and Fisher 100 per cent of aged individuals (65 years and over) died if 25 per cent of the surface of the body was involved in the burn Ziffren reported that of 34 patients *over 60 years of age, 41* per cent died, *that* the *mortality* rate climbed sharply after 70 years of age and that among those over 60 years who succumbed an average of 23 per cent of the surface was deeply burned All these data are in keeping with experi*ences at The New York Hospital and at* Bellevue Hospital (Second Surgical Division) which *indicate* that mortality in the aged burn patient is very high and that it increases with successive age decades A number of factors are responsible for this First and most *important is the factor of* stress Usually the aged patient who has *been burned is in a state of shock when* first seen, even though the area of surface *involvement be no greater than 10 per cent* Vigorous treatment of shock is imperative Referring to the standard regimen for the treatment of burns it is correct to state that the steps in management must be more rigorously applied in the aged subject These include (1) insertion of a polyethylene cannula in an accessible vein for withdrawal of blood samples and for intravenous therapy (2) insertion of an indwelling catheter (3) coverage of the burned areas with sterile dressings (4) administration of *small* doses of morphine intravenously In aged persons whole blood is more valuable than plasma plasma substitutes or expanders The hematocrit is not to be followed exactly as a guide to intravenous therapy, because of the danger of overloading the vascular system The urinary output is perhaps the best guide to prognosis and to requirements of intravenous fluid Urinary output of 50 cc per hour gives a good prognosis Local treatment is not important in the early burn It is important only to make the patient comfortable as soon as possible Sterile dressings do this by excluding wind currents which *even though slight in the average interior* cause exquisite local pain in superficial burns, thus contributing to the patient's stress and its reflected shock Evans's formula (Table 30 1) is used in this clinic for the treatment of hemic, electrolyte, and fluid *imbalance in burns*

The computation in Table 30 1 is for a man of young or middle age It is well to guard closely the total amount of intravenous fluid in the patient over 60 Once the patient has definitely avoided shock or *recovered from it the clinician must direct* his attention to the burned areas The greater the area of involvement the more cautiously must one proceed in the elderly patient Surgical debridement of slough of thermal trauma is the procedure of choice If this is done during the stage of toxic reaction (24 to 72 hr postburn) the aged patient may succumb to overwhelming bacteremia Nevertheless surgical excision of thermal slough is the best treatment in those patients who can withstand the procedure It is directed toward the objective of prompt grafting of the wounds *The longer the period* between burn and grafting the greater the chance of death because the anemia produced by sepsis and the continued loss of protein contribute to the debility of the

TABLE 30 1 EVANS'S TREATMENT *

Plasma plasma substitute or whole blood	(70 × 35 × 1 cc)	2 450 cc
Electrolyte solutions (0 9% NaCl)	(70 × 35 × 1 cc)	2 450 cc
5% glucose in water		2 000 cc
Total to be given intravenously during first 24 hr		6 900 cc

* For burn of 35% of body of man weighing 70 kg

aged patient Superficial burns those of first and second degree may be treated by any available bland ointment If the patient does not seem able to withstand surgical debridement valuable time may be gained by applying pyruvic acid starch paste at 48 hour intervals according to the technique of Connor and Harvey This agent lowers the pH of the tissues to 1 9 and releases enzymes (cathepsins) from the tissue which separate the slough Protein loss is abated and the patient is quickly removed from the morbid state once the wounds have been covered with skin grafts In old people it is wise to cut the grafts as thin as possible and to cover the donor sites quickly so that blood loss is minimal For details of treatment the reader is referred to the author s recent publication on the management of burns Death from burns in aged subjects commonly occurs during the stages of shock and toxic reaction but a very high percentage die from vascular complications (thrombosis and infarction)

In summary in view of the established knowledge that mortality of burns increases with age and is significantly higher in aged subjects than in those of middle age it is apparent that the elderly patient with a burn of even limited area has a grave prognosis and requires the ultimate in correlated care of the burn locally and of the patient generally The high incidence of thrombosis and infarction and the fact that cardiac reserve often is diminished in these subjects demands the most intelligent correction of altered fluid electrolyte and protein imbalance In burns of the aged just as in others the most effective therapy is the early debridement of the burns followed by the prompt application of skin grafts but the first step must be performed with the exercise of accurate surgical judgment The second step the grafting not only heals the area locally but allows the patient quickly to reverse the abnormal electrolyte and colloidal chemistries Burns in the aged tax the best efforts of the most able attendants

TUMORS OF THE SKIN

In this chapter it is not possible to list all the types of tissue transfer which apply to the management of defects created by excision of malignancy of the face and neck Classic examples are described and illustrated In general it may be said that adequate margin may be applied in the excision of carcinoma in the aged and in a higher percentage of cases than in younger age groups satisfactory closure may be accomplished after undercutting and by suture of advanced regional tissues Facial wrinkle lines are shown in Fig 30 7 Proper lines of elliptical excision of skin tumors in the various locations are shown in Fig 30 8 Excision and closure by suture is the ideal in surgical closure of defects created at

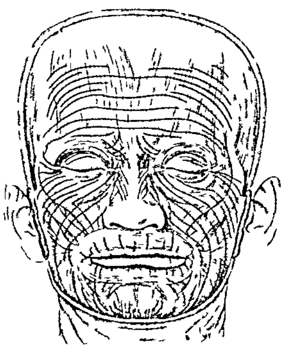


Fig 30-7 Wrinkle lines of the face run at right angles to the underlying musculature By placing lines of excision so that the resultant line of suture will lie parallel to or within these wrinkle lines an unnoticeable scar can be anticipated (*Reproduced from Kraissl C J and Conway H Excision of Small Tumors of the Skin of the Face with Special Reference to the Wrinkle Lines Surgery 12 592 1949 with permission of the Journal*)



Fig 30 8 Outlines of accepted incisions for removal of tumors of the skin of the face Note that long axes of incisions parallel the lines of facial expression Adherence to these directions results in unnoticeable scars (*Reproduced from Kraissl C J and Conway H Excision of Small Tumors of the Skin of the Face with Special Reference to the Wrinkle Lines Surgery 12 592 1949 with permission of the Journal*)

operation The very relaxed state of the tissues is in itself an indication for cosmetic correction in those whose approach to the late years of life make cosmetic surgery desirable This state also makes it easy for the surgeon to advance neighboring tissue and to accomplish closure by linear suture Practically all areas of the face lend themselves to wide undercutting without injury to the underlying branches of the facial nerve, so that closure can be accomplished in a line of suture which is parallel to the wrinkle lines of the skin

Grafts of skin are of value in older subjects just as they are in others Degrees of arteriosclerosis of soft tissues in older persons do not seem to affect the success of free grafts Moreover, donor sites heal with ordinary expectancy, and whole thickness grafts are obtained readily from the areas of relaxed skin of the lower cervical or clavicular regions *Pedicle flaps* do well in aged subjects but these should not be developed in such a way that their migration causes fixation of skeletal joints even for short periods of time It is true, though that tubes or flaps of pedicled tissue do develop collateral circulation Since we would not expect such collateral to develop in the soft tissues of an aged subject as rapidly as in a younger one, the tests for circulatory efficiency especially the *histamine wheal test* are all the more valuable in the determination of the earliest date after construction or migration on which a given pedicle may be transected safely

Benign Tumors of the Skin

Dermatoses common to the geriatric patient manifest themselves in the fifth, sixth, or later decades Those of light complexion, those who have been exposed excessively to bright sunlight (sailors, farmers) and those with predisposing dermatologic states such as postradiation dermatitis or xeroderma pigmentosum may exhibit the dermatoses of old age in earlier decades of life

Senile sebaceous adenoma is acquired in the fifth or sixth decade Atrophy does not occur in these glands during old age but, on the contrary, hypertrophy may cause adenomas which present as smooth yellow, raised areas with central umbilication They commonly appear on the forehead and are not premalignant Removal is indicated because of uncertainty of diagnosis or for cosmetic reasons

Senile hemangiomas develop commonly on the trunk or especially on the upper chest Their diameter varies from 1 or 2 to 3 to 5 mm They are not of clinical importance and often disappear spontaneously

Sclerosing hemangioma is an acquired benign, cutaneous tumor usually about 0 5 cm in diameter dark red to brown in color



Fig 30-9 *A* Photograph of seborrheic keratoses of the temple This is a common benign tumor of the skin of the aged *B* Photomicrograph showing marked production of keratin and interlacing of the rete pegs (*Reproduced from Tumors of the Skin by H Conway with permission of publisher Charles C Thomas Publisher Springfield Ill*)

firm and elevated It is most common over the extremities Microscopically the tumor is composed of vascular channels compressed by fibrous tissue interspersed with foam cells This tumor often occurs over the lower extremities Treatment by surgical excision is dictated only for cosmetic reason

Papillomas are the acquired protuberant cutaneous tumors composed of loose syncytium of alveolar tissue covered by epithelium As the skin degenerates with age these papillomas tend to appear They are easily excised by scissors or scalpel without need for suture

Seborrheic keratoses develop in middle age or old age over the covered portions of the body especially over the back in the submammary areas and on the temples (Fig 30-9) They occur in oily skin and are elevated scaly dark brown patches often confluent They have a stuck on appearance Itching is a common symptom and pain may be associated with inflammation Some (Block Jadassohn) consider these to be benign but others (Sachs McCarthy) state that they occasionally develop into carcinoma Conservative treatment (electrocoagulation carbon dioxide snow) usually suffices but rapid growth represents an indication for excisional surgery

Senile keratosis (actinic keratosis keratoma senilis) develops most commonly in individuals with limited cutaneous pigmentation i e those with fair complexions (Fig 30-10) Such individuals develop freckles readily and in the older age groups these may show thickening of the keratin layer of the skin and atrophy of the prickle cell layer of the skin The microscopic finding of irregularity of size shape and staining qualities of the cells together with significant numbers of mitoses represents a picture of a keratosis which is fertile for the develop-



Fig 30 10 Senile keratosis of the cheek of 2 years duration a common cutaneous tumor of the aged (*Reproduced from Tumors of the Skin by H Conway with permission of publisher Charles C Thomas Publisher Springfield Ill*)

ment of epidermoid carcinoma The fact that keratoses develop frequently and as multiple lesions in people in the sixth seventh and eighth decades of life (as well as in older individuals) attests to the contributory role of senescence in the production of the localized cutaneous horn (a precancerous lesion) The increased rate of cellular division and of exfoliation of keratin cells in those individuals who are exposed constantly to the sun s rays causes their skin actually to mature earlier than would have been the case without such exposure Thus the *actinic keratosis* actually a presenile form of senile keratosis is known also to be a frequent site for the development of epidermoid carcinoma On histologic examination of sections of skin of soldiers living in the tropics for several successive years it was noted that there was excessive activity of epidermal cells with great thinning of the protective keratin layer presumably due to premature and rapid desquamation in association with constant and excessive diaphoresis Both senile and actinic keratoses occur most frequently on the exposed surfaces of the body (face neck and hands) On clinical examination the lesions are single or multiple They show superficial scaliness which if removed may present a bleeding surface which promptly is replaced by further scale accumulation Thus a cutaneous horn may develop Many of these lesions are treated effectively by such simple measures as curettage followed by trichloracetic acid by electrodesiccation or by x ray therapy However such method of treatment denies the all important microscopic study of the lesion Senile keratosis suspected of being carcinoma should be treated by *surgical excision* so that accurate diagnosis is



Fig 30 11 Cutaneous horn which developed gradually over a period of 6 months in a woman 68 years of age It is uncommon to find horns of such length However the aged are apt to neglect skin tumors and allow such horns to develop Twenty per cent of cutaneous horns become malignant (*Reproduced from Tumors of the Skin by H Conway with permission of publisher Charles C Thomas Publisher Springfield Ill*)

possible Multiplicity of lesions may dictate that only those suspected of carcinomatous degeneration be removed

Cutaneous horns (cornu cutaneum) are cornified columnar outgrowths from the skin (Fig 30 11) They are desiccated hard masses of keratinized material This corni fied tissue may present as one firm mass jutting out at right angles to the surface of the skin or as several hard closely packed papillas The base is infiltrated by fingerlike extensions of fibrous tissue The vessels at the base of the lesion show perithelial infil tration The condition is not painful but it causes discomfort because it is subject to frequent trauma from clothing or from minor injury Such trauma causes hemorrhage into the tissue at its base The condition may occur anywhere on the surface of the body It is commonly seen in persons under 40 years of age In the 6 year period from 1948 to 1953 nine specimens of cutaneous horn were presented in the 22 654 tumor speci mens examined in the Surgical Pathology Laboratory at The New York Hospital Roughly 20 per cent of cutaneous horns undergo malignant degeneration (squamous cell carcinoma) at their bases (Fig 30 12) Thus the cutaneous horn must be looked upon as a premalignant lesion Treatment is by *surgical excision*



Fig 30 12 Cornified squamous cell carcinoma which developed in a cutaneous horn of the little finger There had been a laceration of the tip of the affected finger followed by infection 46 years earlier This lesion was treated by digital amputation Cornification of cutaneous carcinoma is much more common in the aged than in younger persons (*Reproduced from Tumors of the Skin by H Conway with per mission of publisher Charles C Thomas Pub lisher Springfield Ill*)

Malignant Tumors of the Skin

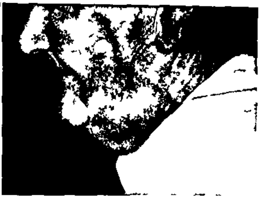
The increasing tendency for cutaneous carcinoma to develop in aged person makes it necessary for the physician to observe closely new growths of the skin in this group of patients That an increased incidence of cutaneous malignancy is encountered in per sons over 60 is an established fact More over social conditions have been affected by widespread introduction of early retirement (usually age 65) so that aged individuals are in a position to be exposed more con stantly to the open air and sunshine factors which are contributory to the development of cutaneous cancer in those whose skin is in a state of reduced vitality In the examina tion of individuals over 60 years of age it is not uncommon to find small cancers of the skin of the face which were not recognized previously (Figs 30 13 to 30 15)

Frequency

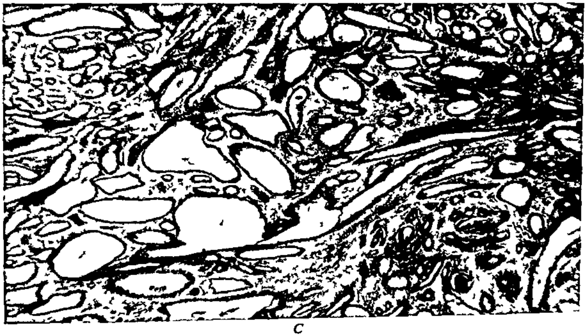
In a report on 1 000 malignant tumors of the skin in elderly patients Andrews and Domonkos found that 81 7 per cent were basal cell epitheliomas 12 5 per cent were squamous cell tumors and 2 8 per cent were other types of cutaneous malignancy such as basosquamous tumors and intraepithelial carcinomas Of more interest in discussion of skin cancer in the aged is their informa tion that 25 per cent were in patients aged 50 to 59 years 29 per cent in patients 60 to 69 years 15 7 per cent in patients 70 to 79 years of age and 5 8 per cent in patients 80 years of age or older Among these 1 000 patients 505 or 50 5 per cent of those 60 years of age or older, had some form of



A



B



C

Fig 30 13 *A* Hydradenoma of the cheek in a patient 81 years old who recognized that a pedunculated tumor had been present in that area since 13 years of age *B* Appearance after surgical excision *C* Photomicrograph of the hydradenoma (low power) There is an overproduction of varying sized and bizarrely shaped sweat gland channels which are lined by flattened columnar epithelium This is an uncommon tumor of the skin of the aged (*Reproduced from Tumors of the Skin by H Conway with permission of publisher Charles C Thomas Publisher Springfield Ill*)

cutaneous cancer This mass analysis points up the fact that cancer of the skin is indeed a disease of *aged skin* Some contend that cancer of the skin does not occur in normally healthy skin but only in those whose integument has undergone the atrophy and other changes caused by senescence Thus it could be argued that skin which develops malignancy is physiologically, though not necessarily chronologically in the aged state It is fair to assume that cancer of the skin is a disease of the aged despite the fact that analysis of records of patients hospitalized for the treatment of cancer of the skin does not support this assumption Analysis of cases at The New York Hospital showed that of 143 cases of squamous cell carcinoma of the skin 72 were in patients under 60 years of age while 71 were in patients over 60 years of age Of 317 basal cell carcinomas of the skin 170 (56 6 per cent) were in persons over 60, while 147 (46 4 per cent) were in those under 60 years of age These figures must be interpreted in

relation to the age of the hospital population at large, but data on this aspect of hospital care are not available Carcinoma of the skin occurs predominantly on the exposed areas (hands and face) where it is readily visible and easily accessible to treatment In general these tumors are of relatively low grade malignancy and they grow slowly Those types which metastasize do so rarely in the early stages the line of extension being to the regional nodes Therefore the rate of curability is high in comparison with that of carcinoma of the interior of the body Nevertheless carcinoma of the skin can be a grave lesion for this type of tumor was responsible for 33 635 deaths in the United States from 1931 to 1940 and for 41 046 deaths from 1940 to 1951 In an analysis of 840 cases of carcinoma of the skin Ward and Hendrick found that 60 per cent occurred in persons 60 years of age or older Pack and LeFevre found that the average age of 1,374 patients with basal cell carcinoma of the skin was 61 years

Site of Carcinoma of the Skin

As stated above these tumors occur most commonly on the face neck and hands Ward and Hendrick found that of 823 malignant cutaneous tumors 94 were on the eyelids 244 on the nose 217 on the cheeks 79 on the forehead 99 on the ears 34 on the scalp 14 on the chin and 42 on the neck

Basal Cell Carcinoma

This classification includes hair matrix carcinoma adnexal carcinoma and rodent ulcer The typical early lesion is a waxy discrete nodule of grayish yellow or pink color often with telangiectasis just below the surface It may progress to scaliness to ulceration or to subcutaneous nodule formation The rodent ulcer is characteristically a burrowing ulcer without much regional inflammation or invasive tendency The importance of these tumors lies in the fact that they are *quite tenacious* i e they tend to recur locally Metastasis is quite rare



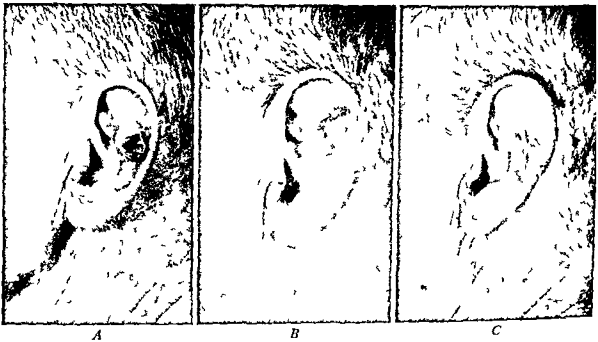
Fig 30 14 Psoriasis of the scalp of 30 years duration with the recent development of squamous cell carcinoma as a nodular elevation just off the midsagittal line of the scalp This inflammatory condition of the skin is an example of the influence of chronic inflammation in the development of carcinoma of the skin of the aged (*Reproduced from Tumors of the Skin by H Conway with permission of publisher Charles C Thomas Publisher Springfield Ill*)

only one case of basal cell carcinoma of the skin (of the ear) with metastases to regional nodes having been encountered in a 22 year period in The New York Hospital (Conway) The clinical significance of the basal cell carcinoma lies in the fact that if untreated or treated inadequately erosion through important underlying structures may cause the death of the patient Thus basal cell carcinomas may erode through the skull or the orbit to the brain or through the naso malar tissues to cause fatal hemorrhage from the internal maxillary artery Review of 317 basal cell carcinomas in the records of The New York Hospital showed that 158 were in males and 159 were in females 170 *(53 6 per cent) were in persons over 60* years of age while 147 (46 4 per cent) were



A B C

Fig 30 15 *A* Basal cell carcinoma of the external nose which developed slowly over a 4 year period *B* Treatment was by amputation of the soft tissue of the nose and reconstruction by forehead flap *C* Appearance of the patient 5 years after construction No recurrence of the disease (*Reproduced from Tumors of the Skin by H Conway with permission of publisher Charles C Thomas Publisher Springfield Ill*)



A B C

Fig 30 16 Technique of partial reconstruction of the external ear following excision of squamous cell carcinoma *A* Appearance of the lesion *B* Appearance after the first operation in which the middle third of the ear was excised The margins of the auricular wound were sutured to the postauricular skin At the second operation a graft of cartilage was carved suitably and inserted under the aural skin *C* Appearance after elevation of the constructed ear and its backing by skin graft (*Reproduced with permission of authors and Journal from Reconstruction of the External Ear by H Conway C G Neumann J Gelb L L Leveridge and J M Joseph Ann Surg* 128 226 1948)

TABLE 30 2 BASAL CELL CARCINOMA *

Site	Over 60			Under 60		
	Total	Male	Female	Total	Male	Female
Nose	51	3	8	3	18	1
Forehead	31	14	17	1	6	6
Cheek	2	14	8	28	8	20
Eyelid	19	11	8	31	16	15
Face	11		4	15	8	
te	11	5	6	9	4	5
Neck	6	3	3	1	1	0
Back	[illegible]	5	[illegible]		1	1
Chest		4	1	0	0	0
Ear	5	1	4	[illegible]	2	0
Multiple	4	[illegible]		1	1	0
Leg	4	4	0			0
Shoulder	2	1	1	2	1	1
Scalp	2	0		4	2	2
Arm	2		0	1	1	0
Abdomen	1	0	1	0	0	0
Chin	1	0	1	0	0	0
Hand	1	1	0	1	1	0
Vulva	0	0	0	1	0	1
Lip	0	0	0	2	2	0
Breast	0	0	0	1	0	1
Total	18			150		

The e w 335 basal cell carc oma 1f w males f wh h 93 were over 60 a d 73 were u der 60 y 169 w e t f m les f wh h 86 w ove 60 a d 83 w d 60 yr 1 3 w re i pers n v 60 yr d 1 f were n perso der 60 yr O ly 4 f these les on w i Negroes all of whom e e 60 yr

in those under 60 years Of the males 89 were over 60 and 69 were under 60 years of age Of the females 81 were over 60 and 78 were under 60 years Table 30 2 lists the sites the two age groups (over and under 60 years) and the sex in these 317 cases of basal cell carcinoma of the skin

Squamous Cell Carcinoma

This tumor is referred to also as *pavement epithelioma prickle cell carcinoma* and *epidermoid carcinoma* (Figs 30 16 and 30 17) In the early stages squamous cell carcinoma is likely to resemble basal cell carcinoma closely but the squamous cell lesion tends to be more firm and more clearly defined It may originate as a small pimple surrounded by an indurated area which does not heal Details of history regarding the duration of the lesion are most helpful in diagnosis for the squamous cell carcinoma of a few weeks duration may equal the size of a basal cell carcinoma of several months or even years duration The primary lesion soon is surrounded by new papules and central ulceration occurs followed by ulceration of the peripheral papules and the formation of new peripheral papules These form an elevated firm border which may be serrated undermined and distinctly indurated The degree of induration about the lesion is a significant sign in the differential diagnosis between basal cell and squamous cell carcinoma of the skin The center gradually deepens into a crater with an irregular base which may be covered with a crust formed of dried serosanguinous exudate and necrotic tissue Occasionally small pearls may be expressed from the ulcer Microscopically these pearls are whorls of epidermal cells

Squamous cell carcinomas may originate in forms similar to the keratoses from which they often are derived as flat spreading hard patches which are sluggish in development of ulceration and which tend to fade off into the surrounding areas Ulcerated forms tend to grow rapidly and may metastasize to regional lymph nodes promptly Growth may be superficial or the lesion may burrow into the deeper tissues with minimal effect on the cutaneous surface In general ulceration is more rapid than in basal cell carcinoma A papillary form also occurs This may be pedunculated or may have a broad base Such lesions are usually more firm than the fungoid basal cell carcinomas but they may be covered with crusts or scales which on removal leave a bleeding surface just as basal cell carcinomas do Necrotic portions may be sloughed off from the ulceration Squamous cell carcinoma is a much more malignant form of skin carcinoma than is the basal cell type of carcinoma Its ready metastasis to regional glands and its relative rapidity of growth point up the necessity for differential diagnosis between the two types of skin tumor Again it is stated that microscopic examination of skin lesions which are suspected of being carcinoma is of the utmost importance One hundred and seventy nine squamous cell tumors of the skin were encountered among 22 654 tumor specimens presented for study

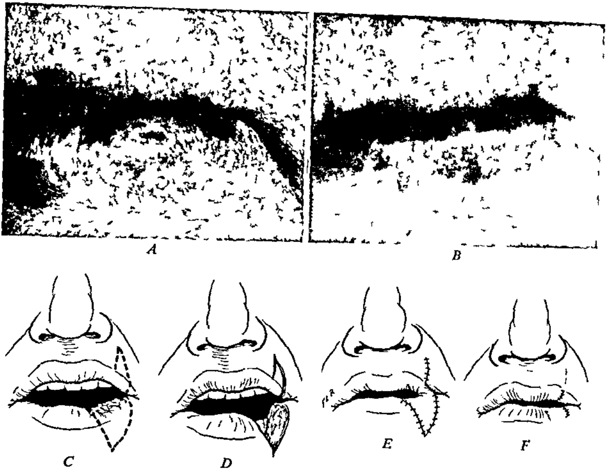


Fig 30 17 Illustrating the use of the Abbe Estlander flap for the correction of defects created by the excision of tumors of the lip *A* Squamous cell carcinoma of the lower lip near the angle of the mouth *B* Postoperative appearance of the patient *C* and *D* The horizontal dimension of the wedge shaped excision is twice that of the horizontal dimension of the vermilion border flap which is developed from the upper lip *E* The flap is rotated at the time of the excisional surgery and sutured into the defect of the lower lip *F* Pedicle is divided 8 days later (*Reproduced from Tumors of the Skin by H Conway with permission of publisher Charles C Thomas Publisher Springfield Ill*)

(during the 6 year period from 1948 to 1953 inclusive) to the Surgical Pathology Laboratory of The New York Hospital In this laboratory basal cell carcinomas were more than twice as frequent as squamous cell carcinomas Squamous cell carcinoma originates in the epidermis particularly in the prickle cells modifications of which are found commonly on microscopic examination Histologically these tumors are rated as to relative malignancy (grade I to IV, Broders) depending upon the degree of cellular differentiation the tendency to invasion the number of mitoses, and the amount of pearl formation Broders found that only 10 per cent of grade I tumors recurred following excision, whereas only 10 per cent of good results were obtained following excision of grade IV tumors The presence of pearls in the microscopic section is not pathognomonic since they occasionally occur in various benign lesions Irregular keratinization is characteristic of the lesion According to the direction of the growth, the degree of ulceration and other factors details of the microscopic examination may vary Early metastases to regional nodes is evidence that the tumor is a highly malignant squamous cell carcinoma The importance of early diagnosis of this lesion is immediately apparent since squamous-cell carcinoma is capable of producing not only regional spread to nodes but also distant metastases Taylor et al reported that 66 of 335 cases

(20 per cent) showed lymph nodal involvement Lesions of the lower extremity metastasized the most frequently However according to Ackerman and del Regato only 5 per cent of epidermoid carcinomas of the skin of the face and neck metastasize to glands Those of the trunk and extremities metastasized to regional glands more frequently Since the clinical appearance of basal cell and squamous cell carcinoma of the skin may be similar *biopsy of cutaneous lesions suspected of being carcinoma is imperative* Review of the records of The New York Hospital showed that of 143 cases of *squamous cell carcinoma of the skin* 92 were in males and 51 in females and that 72 of these occurred in persons under 60 while 71 per cent were in persons over 60 years of age This indicates a predominance of these tumors in the aged since the population of the surgical service in this hospital is significantly higher in the younger age group

Analysis of the site of occurrence the age and the sex of these 143 patients is given in Table 30 3

TABLE 30-3 SQUAMOUS CELL CARCINOMA *

Site	Over 60			Under 60		
	Total	Male	Female	Total	Male	Female
Nose	11	[illegible]	4	10	5	5
Hand	13	9	4	7	4	3
Ear	10	9	1	1	1	0
Cheek	7	7	0	6	3	3
Face	6	3	3	3	3	0
Thigh	5	[illegible]	3	4	3	1
Forehead	4	[illegible]	2	1	0	1
Eyelid	4	[illegible]	[illegible]	3	[illegible]	1
Scalp	3	2	1	[illegible]	5	[illegible]
Lip	3	3	0	[illegible]	1	1
Neck	[illegible]	1	1	5	3	[illegible]
Chin	[illegible]	1	1	1	1	0
Foot	[illegible]	0		4	3	1
Breast	2	0		0	0	0
Antrum	1	1	0	0	0	0
Tongue	*1*	*1*	*0*	*1*	*0*	*1*
Arm	1	1	0	3	3	0
Groin	0	0	0	1	1	0
Perineum	0	0	0	3	1	
Back	0	0	0	1	1	0
Chest	0	0	0	1	1	0
Palate	0	0	0	1	1	0
Pilonidal	0	0	0	1	1	0
Total	[illegible]			66		

There were 143 cases of epidermoid carc[illegible]m[illegible] 9[illegible] of these cases were in males of which 47 were over 60 a d [illegible] w re under 60 yr 51 of these ases were in females of wh[illegible]h [illegible]4 w re ove 60 a d [illegible] w re unde 60 yr [illegible] pat e ts were [illegible]de 60 yr a d 71 were ov 60 yr Only 3 of these les o s occ rred n N groes 1 was v and [illegible] w re u d 60 yr

DECUBITUS ULCERS

A fortunate development of World War II was the solution to the problem of decubitus ulcers in veterans of the Armed Forces who suffered from paraplegia Surgical intervention by excision of the ulcer removal of the underlying bony prominence (trochanter sacrum or ischium) closure by rotation of regional flap of skin and fat and the use of a free skin graft over the muscular area from which the flap was rotated was found to effect permanent healing in approximately eighty five per cent of these cases A number of investigators applied the same method of treatment to decubitus ulcers which were the result of injury in civilian life The management was the same and comparable results were reached Others applied the same technique of management to decubitus ulcers in old people Here the problem is of greater magnitude The aged patient who develops decubiti usually has done so because of general debilitation This is magnified by the relative inactivity of old people often associated with prolonged bed rest and with incontinence of urine or feces or both The problem posed by a decubitus in the aged patient is greater than in younger persons In only a few cases the author has found that the general condition of the patient and the state of his tissues was such that extensive surgery could be applied with good results A more conservative pattern of therapy has been advised for decubiti in old patients This consists in the cleansing of the wound by debridement or by the use of fibrinolyzing agents such as streptodornase and streptokinase or plasmin After suitable sterilization of the wound a free graft of skin can be successful It is well to treat skin grafts to the wounds by frequent change of wet dressings postoperatively Closure of the decubitus by this technique prevents the continued loss of fluids proteins and electrolytes so that

the general condition of the patient improves However, the grafted area must be protected constantly from trauma

COSMETIC SURGERY

Effect of Age on the Skin

The age of a person is estimated in social circles by inspection of the skin i e the number of wrinkles their degree, loss of facial expression in association with atrophy of subcutaneous tissue and of facial musculature the presence of the commonly recognized old age spots (pigmentations) the loss of pigmentation of the hair (graying) the paucity of scalp hair in men and occasional overabundance of hair in undesirable locations in women These are the commonly accepted signs of age The pathology underlying these changes is understood but poorly, and precious little has been contributed to the medical literature on this subject

Contributory factors include the following excessive exposure to the wind to the sun and to salty air (provocative of multicentric cutaneous carcinoma known as *sailors'* or *farmers disease*) the preexistence of chronic dermatoses, such as xeroderma pigmentosum, or postirradiation effects minimal pigmentation in the stratum granulosum of the skin of blond subjects (red haired or freckled persons) persistent malnutrition, prolonged emotional imbalance and endocrinologic disturbances Based upon these contributory factors, the chronologic age may vary significantly from the physiologic age In addition there is familial variation in that some stocks appear to age prematurely, whereas others age slowly These factors are of importance because their presence predisposes to disease of the skin not only to the inflammatory states and the benign tumors but also to cutaneous cancer

Dermatolysis or the state of inelasticity of the skin which is associated with age is a progressive condition which starts actually in the third decade of life At that time wrinkles appear, commonly the horizontal ones over the forehead and those at the nasolabial lines These wrinkle lines are the direct effect of contraction of the facial musculature which inserts in large measure into the dermis of the skin Thinning of the subcutaneous fat pad with advancing years causes more intricate reflection of the contractions of the facial platysma sheath in the lines of expression of the face Individuals who have small amounts of subcutaneous fat in the facial area show wrinkling early in life the effect of repeated animation The myth that a fat man always has a jolly or happy disposition is based on failure to appreciate the fact that facial expressions of unpleasant type (frowns grimaces) are unable by reason of the excessive subcutaneous fat, to reflect themselves in facial lines or wrinkles Continued psychologic stress or persistent and prolonged fatigue is followed by the development, in early life, of persistent wrinkles or furrows of facial areas, which contribute to the early development of the aged face In addition, prolonged obesity, followed by rapid loss of weight due either to illness or to self imposed dietary regimen produces an aged effect, because the stretching of the skin during the period of adiposity produces an elastosis which is not reversed automatically in the short period of weight reduction Wrinkle lines of the face always are at right angles to the line of force exerted by the contracture of the facial muscles Thus, the frontalis muscle, contracting in the vertical plane produces horizontal furrows and wrinkles The corrugator supercilii produces vertical frowns in the region of the glabella the risorius causes nasolabial lines, the orbicularis oculi cause crows feet about the eyelids and the orbicularis oris causes radiating wrinkles around the mouth While prolonged periods of psychic stress or continued physical fatigue produce prematuring wrinkling the effect of the aged face is to impair the psychologic outlook of the subject and contribute to his unhappiness Vanity is common in both men and women It should be looked upon as a desirable trait certainly preferable to an attitude

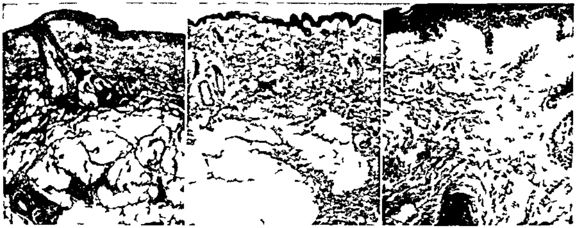


FIG 30 18 Demonstration of the pathologic changes of the skin which occur with ad vancing age *A* Skin of the younger age groups demonstrates the preserved epidermis with rete pegs showing good architectural arrangement corium with its elastic fibers and collagen show no degenerative changes *B* Thinning of the epidermis and loss of rete pegs occur with aging of the skin This specimen is from a 50 year old male *C* Changes characteristic of basophilic degeneration of the elastic tissue in the corium are noted in the skin of this 70-year old patient

of self neglect Aged facial appearance thus contributes significantly and importantly to the feeling of old persons that they are un wanted In the intelligent recognition of the pairing of these two conditions the aged appearance of the face and the unhappy psychic state of the aged subject lies the justification for facial cosmetic surgery the popular face lifting operation known in medical language as *rhytidoplasty*

Pathologic changes of the skin associated with advancing years have been given little consideration In the accompanying illustra tions the histology of the skin of the succes sive age decades is demonstrated by photo micrographs Briefly these changes are as follows (1) epidermal atrophy with flatten ing of the rete pegs and loss of the youthful pattern of the underlying dermal collagen (2) elastosis (abundance of elastic fibers which have undergone degeneration ex- hibited by fragmentation loss of nuclei and wavy pattern and clumping of outlines which is demonstrated by the increased basophilic staining of the tissue (3) sclerosis of dermal arterioles present even in the absence of hypertension (4) loss of pigment of the hair (graying) (5) loss of scalp hair (bald ness) in men and occasionally in women (6) increased growth of hair in nostrils eye brows and external auditory canals in both sexes and on face and extremities in women (see Fig 30 18)

Chemical changes in the skin concomitant with age are (1) increased concentration in the epidermis and dermis of calcium mag nesium total ash and less constantly sodium and potassium (2) decrease in the concentration of silicon and sulfur

Cosmetic surgery for the aged centers around the correction of alterations of the face from changes in the skin (inelasticity wrinkling increased furrows of facial expres sion) which are concomitant with age These changes may be of practical significance in the eyelids where redundant skin of the upper lids actually may overhang the pupil so that vision is impaired The state of re laxation of the lower eyelids may be such that not only objectionable appearance but excessive epiphora may result from the fail ure of function of the punctum of the lowered eyelid Inordinately aged appearance in the subject over 60 may be the cause of severe mental anguish and may even cost the indi vidual his job Severely ptotic and heavy

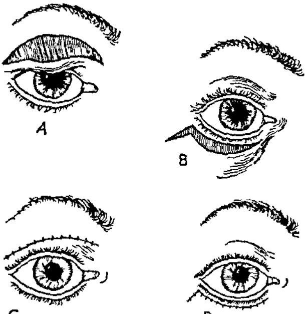


Fig 30 19 *A C* Technique by which redundant skin is excised from an upper lid The limitation of vision shown in the artist s sketch is not uncommon in the older age group *B D* Technique of excision of redundant skin of the lower lid Through this excision any herniated fat may be removed at the same procedure

breasts may be the cause of complaint owing to their ability to limit bodily activity and even to *hamper normal respiration* Redundant abdominal fat aprons may be a justified indication for abdominal lipectomy in the aged subject *The specific states which represent indication for cosmetic surgery in the aged* are listed herein

Conditions of the Eyelids

Redundancy of skin of upper eyelids may be corrected easily by elliptical excision of skin as indicated in Fig 30 19*A*, *C* In severe cases this condition causes ptosis and the loose fold of upper lid skin may cause obstruction to the pathway of vision After excision undercutting should not be done Accurate determination of the amount of skin to be excised cannot be made if tissues are swollen by injection of Novocain *Wrinkling and bagging of lower eyelid skin* can be corrected by excision of skin and suture as shown in Fig 30-19*B D* It is a mistake to excise more than just a little skin under the medial third of the eyelid for generous excision here invariably produces ectropion Again, general anesthesia is required *Fat hernias* are a common finding in the eyelids of the aged Probably they are an effect of prolonged fatigue, for their pathogenesis is that of the bulging of globules of intraorbital fat through the *orbital fascia and the fibers* of the orbicularis oculi This condition is treated easily by the amputation of the herniated fatty masses through small incisions The fascia *but not the musculature should* be closed by suture Many people whose lives have been made unhappy by the fact that they have bags under their eyes could be relieved *of the mental anguish caused* by this condition Unfortunately the medical profession *is not alert to the indications* for or the value of this type of surgery *Ectropion of the lower eyelids develops in the aged* as a result of atony of the musculature It gives rise to tearing and to unattractive appearance It cannot be corrected easily but the *operative procedures for support of the eye lids* in facial paralysis apply in the management of this symptom producing condition The techniques of outer canthoplasty

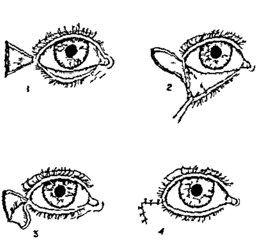


Fig 30-20 The Kuhnt Szymanswski procedure is used in severe cases of senile ectropion 1 Excision of a triangular area of skin immediately lateral to the outer canthus 2 A triangular area of similar size is excised from the conjunctival surface of the lower lid 3 After the lid margin has been denuded and the hair follicles excised the two triangular areas are brought into approximation by sliding the denuded surface of the lower lid laterally 4 Skin closure is completed

(Kuhnt Szymanowski McLaughlin) and of support of the eyelid by rotation of a slip of temporalis muscle or by a strip of fascia lata are shown in Figs 30 20 to 30-22)

Relaxation of Skin of Lower Face

Dermatolysis the name given to relaxation of facial skin is the condition which is corrected by rhytidoplasty (literally, wrinkle excision) commonly known as *face lifting* No longer is it necessary for the plastic surgeon to apologize for this procedure for its usefulness is well established not only to allow persons of prematurely aged appearance to continue in vocation or avocation where appearance of relative youthfulness is essential but also to give spirit hope and happiness to aged individuals whose whole approach to life is marred by constant awareness of the aged appearance of their facial and cervical skin (Fig 30 23) The operative procedure rhytidoplasty is accomplished through incisions which when healed are not apparent The procedure consists of the wide undercutting of facial skin (superficial to the platysma and the

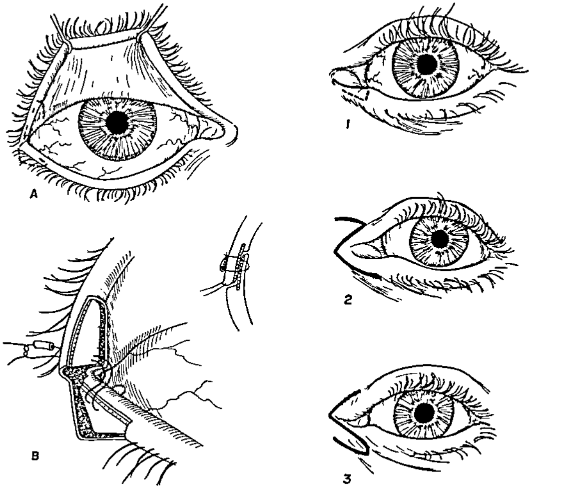


Fig 30-21 The McLaughlin lateral tarsorrhaphy for correction of ectropion in the aged *A* Similar triangles of skin and conjunctiva are excised from the lower and upper lids respectively *B* Suture of the overlapped tarsal plates not only elevates the lower lid but also draws it in a more lateral direction Epiphora is frequently associated with ectropion in the aged 1 The posterior wall of the canaliculus is removed by excision of a triangular area from the inner surface of the lid This makes the passage through which tears must travel as short and direct as possible 2 Internal canthoplasty of Mc Laughlin A small triangular flap from the upper lid is set into the lower lid 3 By making the lower lid longer a slight corrective entropion is produced

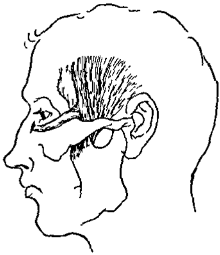


Fig 30 22 Eyelid support for a severe ectropion may be obtained by the use of a small strip of the anterior part of the temporalis muscle detached from its original site rotated down into the lower lid and sutured to the medial canthus (*By H Conway reproduced from Ann Surg 147 1958 with permission of the Journal*)

branches of the facial nerve) through incisions *in the pre and postauricular areas* (Figs 30 24 and 30-25) The skin is pulled up by marginal sutures, cut off and then shirred into approximation with the upper margins of the wound by sutures of No 00000 black silk Excess fat in the submental region should be excised If necessary a small incision may be made in the cervical skin near the midline in order to remove this fatty tissue The procedure may be performed without troublesome bleeding by the use of local anesthesia (procaine with Adrenalin) or general hypotensive anesthesia Hemostasis by accurate clamping and ligature is of the utmost importance for postoperative hematoma may require secondary operation for evacuation of clot The importance of avoiding this complication cannot be overemphasized The inexperienced surgeon is apt to delay when hematoma makes its appearance hoping to evacuate the accumulation by *aspiration This is a mistake*, for liquefaction of clot does not develop until 8 or 10 days after its accumulation at which time fibrous reaction in the subcutaneous tissue may have developed The former *may result in permanently uneven firmness* (lumpiness) of the skin which results in distorted facial expression whereas the latter may result in permanent discoloration of the facial skin In good hands and in properly *selected cases, rhytidoplasty is extremely useful* It should not be performed indiscriminately or on those whose tissues are not sufficiently relaxed to justify operation The plastic surgeon must accept the responsibility for screening the applicants for this surgery as to their psychologic stability the operative risk and the amount that can actually be accomplished at operation The question



Fig 30 23 The upper cervical region is frequently the site of excessive wrinkling in the older patient This can be readily corrected by lower facial rhytidoplasty (see Fig 30 24) *A B* Preoperative views *C D* Postoperative views

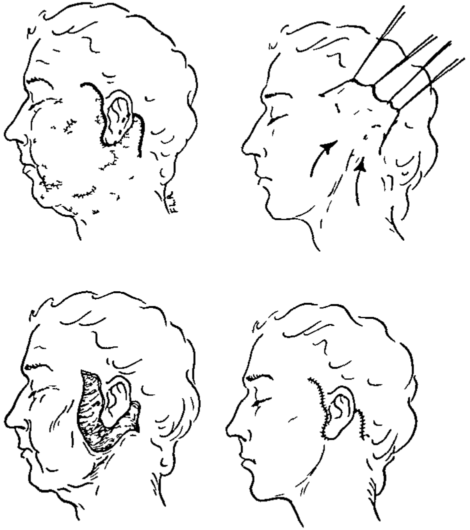


Fig 30 24 The decreased elasticity of the skin which occurs with aging may result in marked facial wrinkling Correction may be effected by rhytidoplasty The skin of the malar and upper cervical areas is undercut widely then rotated upward and backward Overlapping skin is excised and the margins of the patterned wound are sutured (*By H Conway reproduced from Ann Surg* 147 1958 *with permission of the Journal*)

is commonly asked How long will the improvement last? The answer is that if the procedure is effectively performed in a properly selected subject the minimum period of duration of the effect of the operation is 5 years Often it preserves the tautness of the facial skin for 10 years or more At any rate if the operation is effective the patient s appearance from date of operation forward always is better than if the procedure had not been done Good technique in operative procedure does not permit distortion of the mouth It is a mistake to operate on women who are undergoing the menopause because the rate of the aging process is accelerated during that period This admonition also applies to the surgery of the eyelids in the aged

Macromastia and Mammary Ptosis

Reduction mammaplasty may be of value in the aged subject by reason of the nuisance of weighty breasts (Fig 30 26) Heavy breasts may hamper inspiration since the breasts are suspended from the anterior thoracic cage and the elevation of the ribs is limited The heavy breasts act as a lever of the third class more effective pound for pound than the downward pull of the dia



Fig 30 25 *A* A 64 year old subject with excessive wrinkling of the skin of eyelids face and neck *B* After excision of redundant skin of upper and lower eyelids and lower facial rhytidoplasty

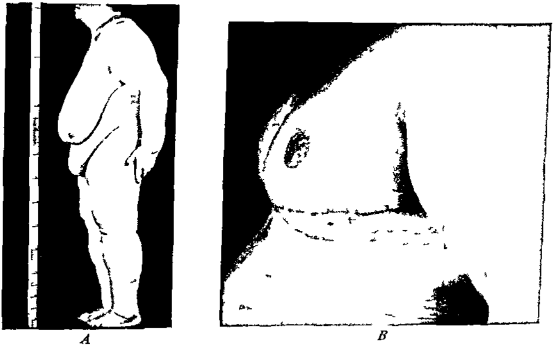


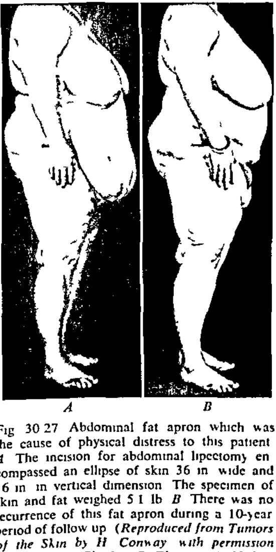
Fig 30-26 *A* Massive breasts and a large abdominal fat apron associated with symptomatic osteoarthritis of the cervical and thoracic spine almost completely incapacitated this 64 year old female *B* Following reduction mammaplasty and lipectomy at which time 12 lb of tissue were removed from the breasts This patient has no spinal complaints and is now able to walk in an upright position without her previous marked limitation of activity

phragm during inspiration The technique usually employed is bilateral partial mas tectomy with formation of a mammary emi nence from the stump of mammary gland The nipple is transplanted as a composite free graft For the technique of the operation the reader is referred to the author s publi cations on this subject

Ptotic breasts may be an indication for corrective surgery in the geriatric patient by reason of their physical nuisance Mastopexy is a safe and reliable procedure which is carried out by undercutting the skin and sub cutaneous tissues of the upper part of the breast denuding the lower breast of excess skin pushing the breast up under the flap and bringing the nipple still attached to its underlying mammary structures out through an opening in the upper flap The physiologic arguments for reconstructive surgery of the breast in the aged do not apply to the patient with ptotic breasts But the effective reposi tion of such breasts does much to restore the mental outlook of the patient

Regional Obesity

Seldom is it justifiable to employ the operative procedure known as *lipectomy* Obesity currently is looked upon as exog enous in origin However in old people whose eating and other habits are fixed weight reduction may be nearly impossible Moreover excessive weight in itself is un- favorable in its effect on cardiorespiratory physiology In addition certain deposits of regional obesity may be the cause of irri tating local symptomatology An example is the redundant abdominal fat apron which usually gives rise to troublesome chronic dermatitis of the skin of the lower abdominal wall and that of the adjacent portion of the fat apron In such cases the circulation in the pendent fat apron is congested to the point that the subcutaneous fat is mildly edematous and indurated It has been found that excision of such an apron is efficacious and that the fat does not reaccumulate in that area The patient must be prepared for operation by attention to the skin A pre- operative period of bed rest with the fat apron held up by adhesive or by pillows so that the skin may be exposed to the air is a necessity Flagrant dermatitis may require therapy with specific ointments The opera tion must be undertaken with the greatest attention to asepsis Hemostasis must be ac- curate and the margins of the wide ab dominal ellipse which is left after excision must be closed with mattress sutures which are tied lightly so that fat necrosis does not result The wound should not be drained because of the feeble resistance of adipose



A B

Fig 30 27 Abdominal fat apron which was the cause of physical distress to this patient *A* The incision for abdominal lipectomy en compassed an ellipse of skin 36 in wide and 16 in in vertical dimension The specimen of skin and fat weighed 5 1 lb *B* There was no recurrence of this fat apron during a 10-year period of follow up (*Reproduced from Tumors of the Skin by H Conway with permission of publisher Charles C Thomas Publisher Springfield Ill*)

tissue to infection Such postoperative infection is a catastrophe following this procedure for the wound often measures 30 to 36 in horizontally and 12 to 15 in in its vertical dimension Applied in the properly selected case abdominal lipectomy for redundant apron of fat is a distinctly useful operative procedure in the aged (Fig 30 27)

TUMORS OF THE ORAL CAVITY

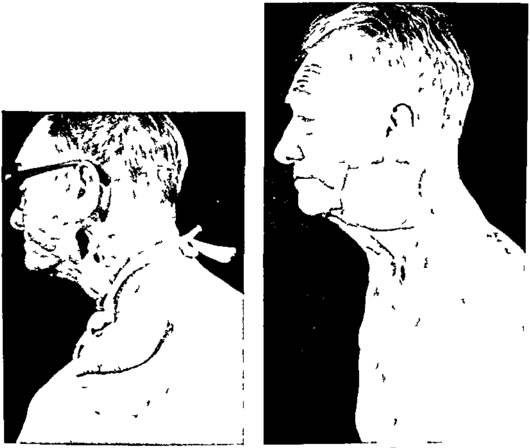
The insidious onset of malignant tumors of the oral cavity and their increased frequency in the aged makes this group of tumors of significant interest to the clinician Very frequently, local discomfort and especially pain are late symptoms Quite often the lesion is first encountered by the dental



Fig 30 28 Squamous cell carcinoma of the alveolus in a 60 year old female *A* Squamous cell carcinoma of the alveolus of the lower jaw adjacent to remaining teeth *B* Preoperative x ray film demonstrating radiologic evidence of bony involvement The tumor necessitated partial mandibulectomy and radical neck dissection *C* Because of the patient s age a primary bone graft was not carried out An intramedullary wire was utilized at this time to hold the mandibular fragments in satisfactory position and to prevent soft tissue contracture At this operation the resection included the cervical glands the body of the mandible (across the midline) the lower half of the ramus of the mandible the gingival tissues with the tumor and a wide section of buccal mucosa and soft tissue of the floor of the mouth *D* Anteroposterior view of mandible following insertion of bone graft *E* Postoperative photograph demonstrates good facial symmetry with little evidence of the operative procedure which this patient underwent There was no recurrence of tumor 8 years later

surgeon during routine dental hygiene The common tumors are the carcinomas of the tongue the gingiva the floor of the mouth the buccal mucosa and the pharynx Also included are the tumors of the tonsil of the hypopharynx and of the hard and soft palates Too often the patient already has positive cervical nodes at the time that he is first examined The hunt for the primary tumor is a most important one which calls for examination of all of the recesses of the nasopharynx and for examination by x ray The clinician who finds positive cervical nodes should not fail to inspect the roof of the soft palate and the base of the tongue by laryngeal mirror It is wise to examine the floor of the mouth the cheeks and the base of the tongue by palpation with gloved finger Dental caries and dental plates often are the cause of irritation to the mucous membranes of old persons Granulation tissue ulcers or persistent areas of inflammation always require biopsy Shedd Schmidt and Chang reported that the median age of 91 patients with carcinoma of the tongue was 65 years Fifty four of ninety one patients were over 60 years of age Eight of eleven patients who lived following surgery were alive and free of disease 5 years following definitive surgery

In this chapter it is not possible to discuss at length all the details of management of the



A *B*

Fig 30 29 *A* Pharyngeal fistula in a 62 year-old male 2 years following radical excision of a squamous cell carcinoma of the hypopharynx *B* Because this fistula produced heavy drainage from the oral cavity and markedly limited the patient s activity a shoulder flap was constructed to close the defect 2 years after initial surgery The patient is at present 3½ years postoperative has no known recurrence of his original carcinoma and has no evidence of recurrence of the fistula

intraoral tumors listed above In general, it is safe to state that aged persons undergo procedures on the oral cavity even to the extent of en bloc resections of cervical glands mandible, and gingival carcinoma with little to suggest any variation from the reaction to such operations by younger subjects (Figs 30 28 and 30 29) In many cases of carcinoma of the oral cavity in old persons the surgical resection is carried out after failure of radiation therapy In such cases the incidence of serious complications increases The fibrosis produced by the therapy may result in severe secondary hemorrhage from an unduly sclerotic cervical artery Also, this fibrosis may result in failure of wound healing, with complicating salivary fistula Such problems call for elaborate correction by the transplantation of flaps of healthy tissue to the area As Glenn and Artusio stated, careful attention must be paid to detail and each member of the surgical team must do his share to prevent stress Thus, the geriatric patient will fare well in the hands of the surgeon and the anesthesiologist working as a team Anglem and Bradford presented the survival rates in 258 patients 70 years of age or more who had undergone major surgery for cancer of the oral cavity Of 18 patients operated upon for carcinoma of the head and neck 9 (50 per cent) survived 5 years This was a better survival rate without evidence of disease (for the aged) than in breast cancer (36 8 per cent) and pelvic cancer (22 2 per cent) but not as good as in cancer of the cecum and ascending colon (60 per cent)

BIBLIOGRAPHY

Adams W M Free Transplantation of the Nipples and Areolae Surgery 15 186 1944

Allen A C *The Skin* The C V Mosby Company St Louis 1954

Andrews George C and Domonkos A N Cutaneous Malignancy in Elderly People J Am Geriatrics Soc 2 678 1954

Anglem T J and Bradford M L The Prognosis of Major Surgery for Cancer of the Aged Cancer 7 888 1954

Aufricht G Philosophy of Cosmetic Surgery Plast & Reconstruct Surg 20 397 1957

Barnes H D Frown Disfigurement and Ptosis of Eyebrows Plast & Reconstruct Surg 19 337 1957

Barsky A J *Plastic Surgery* W B Saunders Company Philadelphia 1938 p 124

Brewer David W Malignancy of the Ear Nose and Throat in Older People J Am Geriatrics Soc 2 480 1954

Brodkin E T Common Dermatoses of the Geriatric Patient J Am Women s M A 10 267 1955

Bull J P and Fisher A J A Study of Mortality in a Burns Unit A Revised Estimate Ann Surg 139 269 1954

Connor G J and Harvey S C The Healing of Deep Thermal Burns A Preliminary Report Ann Surg 120 362 1944

Connor G J and Harvey S C The Pyruvic Acid Method in Deep Clinical Burns Ann Surg 124 799 1946

Conway H Reconstruction of The External Ear Ann Surg 128 226 1948

Conway H Clinical Tests for the Evaluation of Circulation in Tubed Pedicles and Flaps Ann Surg 135 52 1952

Conway H Mammaplasty Analysis of 110 Consecutive Cases with End results Plast & Reconstruct Surg 10 303 1952

Conway H Injuries to the Soft Tissues of the Face Am J Surg 90 891 1955

Conway H *Tumors of the Skin* Charles C Thomas Publisher Springfield Ill 1956

Conway H Management of Burns in *Trauma* American College of Surgeons Grune and Stratton, Inc New York (in press)

Conway H et al The Plastic Surgical Closure of Decubitus Ulcers in Patients with Paraplegia Surg Gynec & Obst 85 321 1947

Conway H et al Complications of Decubitus Ulcers in Patients with Paraplegia Plast & Reconstruct Surg 7 117 1951

Conway H and Griffith B H Plastic Surgical Closure of Decubitus Ulcers in Patients with Paraplegia Am J Surg 91 946 1956

Conway H Neumann C G Gelb J Leveridge L L and Joseph J M Reconstruction of the External Ear Ann Surg 128 226 1948

Conway H and Smith J Breast Plastic Surgery Reduction Mammaplasty Mastopexy Augmentation Mammaplasty and Mammary Construction Plast & Reconstruc Surg 21 8 1958

Conway H Stark R B and Joslin D Cutaneous Histamine Reaction as a Test of Circulatory Efficiency of Tubed Pedicles and Flaps Surg Gynec & Obst 93 185 1951

Conway H Stark R B and Kavanaugh J D Variations of the Temporal Flap Plast & Reconstruct Surg 9 410 1952

Corso P F Variation of the Arterial Venous and Capillary Circulation of the Soft Tissues of the Head by Decades Plast & Reconstruct Surg (in press) Prize winning paper of the Foundation of the American Society of Plastic and Reconstructive Surgery (1959)

Edgerton M T and McClary A R Augmentation Mammaplasty Plast & Reconstruct Surg 21 279 1958

Erich J B and Austin L T *Traumatic Injuries of the Facial Bones An Atlas of Treatment* W B Saunders Company Philadelphia 1944

Evans J E The Early Management of the Severely Burned Patient Surg Gynec & Obst 94 273 1952

Gelb J Plastic Surgical Repair of Decubitus Ulcers in Paraplegics as a Result of Civilian Injuries Plast & Reconstruct Surg 9 525 1952

Glenn F and Artusio J F Jr The Surgeon and the Anesthesiologist as a Team for Geriatric Surgery J Am Geriatrics Soc 4 1956

Harkins H N *The Treatment of Burns* Charles C Thomas Publisher Springfield Ill 1942

Iverson P C Surgical Removal of Traumatic Tattoos of the Face Plast & Reconstruct Surg 2 427 1947

Kazanjian V H and Converse J M *The Surgical Treatment of Facial Injuries* The Williams & Wilkins Company Baltimore 1949

Kellner A Aging and Atherosclerosis Bull New York Acad Med 32 517 1956

Kostrubala J G and Greeley P W Problems of Decubitus Ulcers in Paraplegics Plast & Reconstruct Surg 2 403 1947

Kraissl C J and Conway H Excision of Small Tumors of the Skin of the Face with Special Reference to the Wrinkle Lines Surgery 25 592 1949

Longacre J J Surgical Reconstruction of the Flat Discoid Breast Plast & Reconstruct Surg 17 358 1956

May H *Reconstructive and Reparative Surgery* F A Davis Company Philadelphia 1958 p 181

Metcalf D The Aetiological Significance of Differing Patterns in the Age Incidence of Cancer Mortality M J Australia 1 874 1955

Montagna W *The Structure and Function of Skin* Academic Press Inc New York 1956

Moyer C A An Assessment of the Therapy of Burns Ann Surg 137 625 1953

Pack G T and LeFevre R G Age and Sex Distribution and Incidence of Neoplastic Diseases at Memorial Hospital N Y C with Comments on Cancer Ages J Cancer Res 14 167 1930

Padgett and Stephenson *Plastic and Reconstructive Surgery* Charles C Thomas Publisher Springfield Ill 1948 p 587

Rothman S in panel discussion on the Clinical Management of Skin Disease in Geriatric Patients J Am Geriatrics Soc 6 575 1958

Shedd D P Schmidt N L and Chang C H A Survey of Tongue Cancer Over a Fifteen Year Period in a General Hospital Surg Gynec & Obst 106 15 1958

Sulzberger M B in panel discussion on the Clinical Management of Skin Disease in Geriatric Patients J Am Geriatrics Soc 6 575 1958

Taylor G W Nathanson I T and Shaw D T Epidermoid Carcinoma of the Extremities with Reference to Lymph Node Involvement Ann Surg 113 268 1941

Thorek M Plastic Reconstruction of the Breast and Free Transplantation of the Nipple J Internat Coll Surgeons 9 194 1946

Updegraff H L Reconstruction of the Breast California & West Med 46–47 18 1937

Walden R H and Bromberg B E Recent Advances in Therapy of Maxillofacial Bony Injuries in Over 1 000 Cases Am J Surg 93 508 1957

Ward G E and Hendrick J W Tumors of the Head and Neck The Williams & Wilkins Company Baltimore 1950

Ziffren S E Management of the Burned Elderly Patient J Am Geriat Soc 3 36 1955

Index